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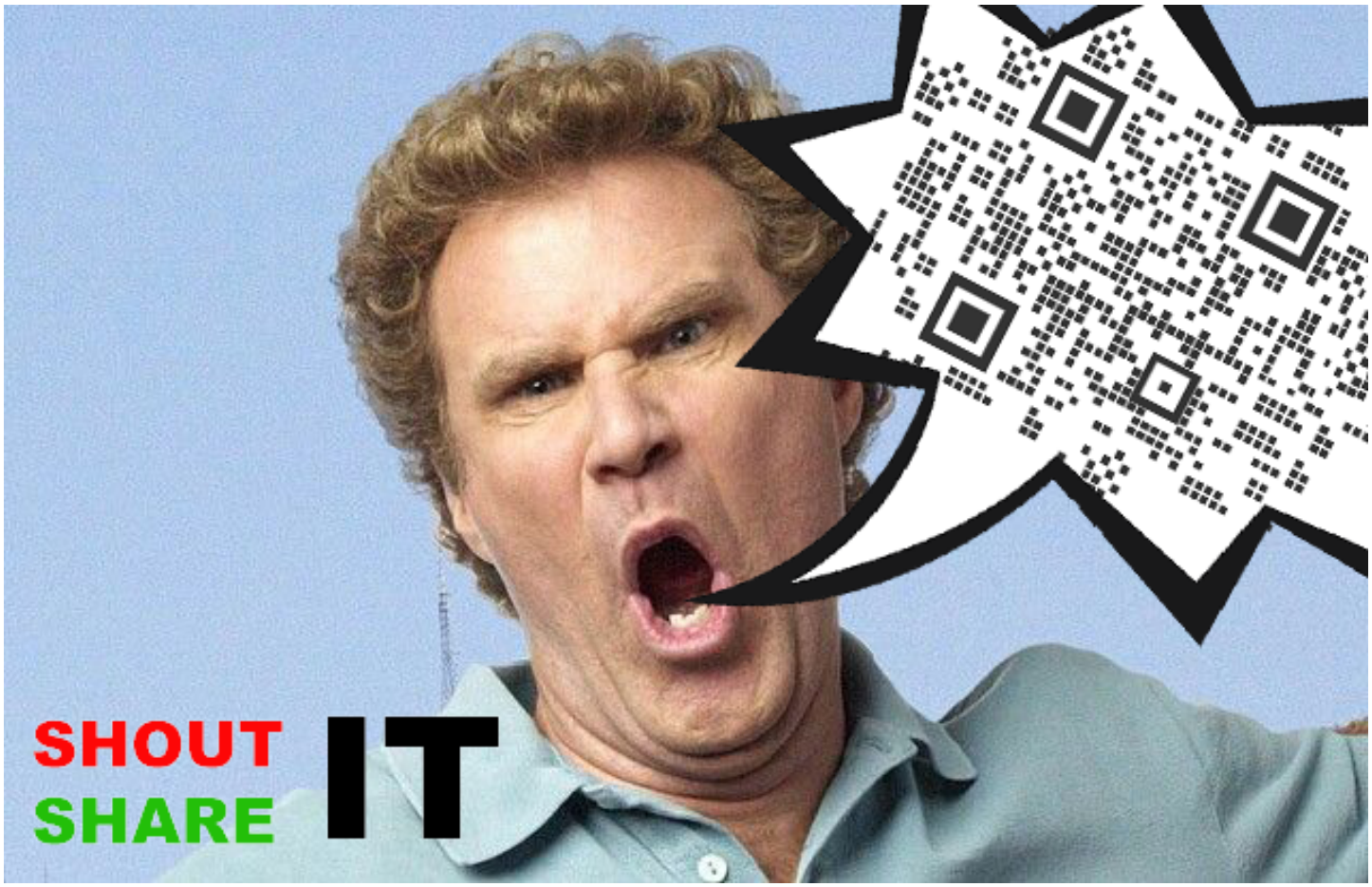
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UNITED STATES DEPARTMENT OF AGRICULTURE

DEPARTMENT BULLETIN No. 1480

Washington, D. C. March, 1927

RELIABILITY AND ADEQUACY OF FARM-PRICE DATA

By

CHARLES F. SARLE, Economic Analyst

Division of Crop and Livestock Estimates, Bureau of Agricultural Economics

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By CHARLES F. SARLE, *Economic Analyst, Division of Crop and Livestock Estimates, Bureau of Agricultural Economics*

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PURPOSE

An adequate knowledge of relative changes in farm-price data, especially as they compare with the trends of other prices, wages, land values, etc., is fundamental as a basis for an intelligent constructive program for agriculture, whether of Federal or State agencies or of organizations of farmers.

Prices and price changes are both causes and effects in the field of economic phenomena. In the long run the prices of farm products tend to control the supply. Changes in farm organization and types of farming can frequently be traced to absolute and relative changes in farm prices. For many problems of this kind it is desirable to have a price series which represents price changes in the local farm

market and at the same time is a composite for a definite geographical unit, such as a State, as well as a composite for the entire crop, including all grades and classes.

This bulletin is designed to meet the needs of those students and research workers in the field of agricultural economics who may have occasion to work with the farm-price data which are collected and published by the Department of Agriculture. It is intended primarily for those students who are familiar with technical, statistical terms. The data published by the United States Department of Agriculture are too often taken for granted by the research worker, largely because the reliability and adequacy of the data have never been fully analyzed. Many students would like to know what is back of farm-price data—how and when collected, and their most obvious limitations before trying to use them in some important economic problem.

DESCRIPTION OF FARM PRICES

PRICES OF FARM PRODUCTS

The prices received by producers of farm products, commonly called "farm prices," represent the price-reporting estimate of the average price of all grades and classes of commodities being sold in the local farm market on or about the fifteenth of each month. The grades and classes vary from one season to another and even from one month to the next. The "wholesale price" of farm products usually means the price of a particular grade or class at a primary or central market, such as Chicago, Kansas City, New Orleans, or New York, for a given day or a weekly or monthly average of daily quotations. Both farm and wholesale prices are distinguished from future prices in that they both represent cash transactions for immediate delivery.

The farm price is seldom an f. o. b. price in the case of potatoes, for example, there is usually some agency at the local market to buy from the producer, and these buyers must receive some compensation for their services. There is usually some spread between the farm price and the f. o. b. price. When the farmer sells direct to the consumer in a neighboring town the farm price and the retail price may be one and the same.

Strictly speaking, the actual farm price or "price at the farm" of a farm product is practically impossible to learn or obtain. The price which is usually obtained is the one the farmer receives at his local market. For most farm products there is no "at the farm" price. The price is made only when the product changes hands. The prices reported to the United States Department of Agriculture are the prices at which the products first changed hands when sold by the producer. The price of wheat as reported includes the cost to the farmer of handling and delivering the wheat to the local elevator. The local handling cost may be relatively large with such products as butter, eggs, wool, and cotton.

SURPLUS-AREA AND DEFICIT-AREA PRICES

The State average of prices received by producers of farm products is made up of prices from both surplus-producing and deficit areas

within the State. The farm price in areas of surplus production (*4, p. 3–5*)[1] tends to be the primary-market price less the costs of marketing which arise from the time the product leaves the farmer's hands until it reaches the primary market. With such crops as cotton and wheat (in years when wheat is on an export basis) the farm price is the world price as the Liverpool price is often called, less the cost of getting the product to Liverpool.

There are different kinds of prices even in a surplus-producing region, as some farmers sell locally, although by far the major portion of the product is marketed through the regular market channels. This is well illustrated by a farmer who sells milk at retail to persons living in a neighboring town, while most of his neighbors deliver to a condensery. In deficit areas there are occasionally farmers who produce several acres of a given crop and who may even be forced to market a part of their product at some distant market. The price in a deficit area is roughly equivalent to the price in the farthest surplus-producing region from which the deficit area must draw its supplies, plus the cost of handling and transporting the product to the deficit area. With a bulky crop like potatoes there is usually considerable difference between the prices prevailing in surplus-producing and deficit areas within the same State. The farm price of cabbage serves as a measure of the general trend of cabbage prices for the entire State, but it does not reflect the wide fluctuations which prevail in surplus-producing areas within the State.

In some States the price of some commodities, such as potatoes or apples, is higher in a surplus-producing area than in those sections which are practically self-sufficient. The price tends to be higher because the surplus produced is large enough to create and maintain an outlet into the general channels of trade, whereas in the self-sufficient area a small local surplus tends to depress the local price. This condition is frequently found in some localities in the Rocky Mountain States.

There are only a few farm products, even in surplus-producing States, which enter the channels of trade in the same general proportion year after year. In a year of low production in certain parts of the country, the usual movement of the crop from the farm to primary markets may be reversed. When the winter wheat crop in Kansas is very short, spring wheat may be shipped into Kansas to take care of the local milling demand, and the usual price differentials between farm and market prices may be materially changed.

During a year when a considerable surplus of corn is produced, the corn price in an Iowa county may be the primary-market price less the cost of handling and transportation to the primary market, say Chicago. The next year the crop may be small; farmers will be buying corn of each other and from nearby counties or States; and the price at which local corn will be sold may be nearly as high as or higher than the primary-market price.

The farm price for a State is usually an average of prices received by farmers as they sell their product all along the line, from the price paid for the product entering the regular channels of trade to the retail price received by the farmer who sells direct to the consumer. It should also include the price received when a

[1] Figures in italics in parentheses refer to literature cited, p. 65.

part of the crop is sold for manufacturing purposes, as starch and potato flour in the case of potatoes, and cider and evaporated stock in the case of apples. Should the farm price include the price received for that part of the crop sold for seed? This can be answered only when we know how the price is to be used. Farm prices undoubtedly include many seed prices.

It is doubtful whether the average farm price as reported really does make full allowance for the sales of low-grade and poor-quality products. It was with this in mind that early in the work of collecting price data it became the practice in rounding a price always to round downward. The State averages of hog prices per 100 pounds are rounded downward to the first even 10-cent price per 100 pounds.

FARM-PRICE QUOTATIONS

Quotations of farm prices tend to group themselves about certain figures divisible by 5 or 10. One hundred and two of the 184 reports as to the price of corn per bushel in Iowa on May 15, 1926, were on the 5-cent interval; the price given ranged from 45 cents in 4 reports to 80 cents in 7. None of the reports gave the price as being between 45 and 50 cents or between 65 and 70 cents. There were only 4 reports that gave the price as between 60 and 65 cents. In 155 reports the prices given ranged from 50 cents through 60 cents; in 88 reports, or 57 per cent of the total number, the prices were 50, 55, or 60 cents.

Hay prices per ton are usually rounded in the reports to the nearest half dollar or even dollar. Prices of dairy cows and horses per head are nearly always given as amounts exactly divisible by 10 or 5.

It is logical that farm prices should be quoted in this way by the reporter, as the prevailing price for a given grade or quality of a product is more likely to be a figure divisible by 5 or 10 than some other figure. Where farm products are not sold by specific grades, local quotations are made to include about the average quality that will be offered and are based upon the primary-market prices being quoted for the grade which the mixed lots will make. Large quantities of farm products are purchased without grade specifications. Unless local competition in buying is unusually keen the local buyer is inclined to set the price at a rounded figure. If farm products are being sold by specified grades and the reporter is asked to make a general average of all sales, he too is likely to round his estimate to a convenient figure.

GEOGRAPHY OF FARM PRICES

Farm prices tend to fall into zones in much the same way as climatic data. Since the general movement of wheat, for example, is toward the centers of population and regions where production is less than consumption, the lowest-price zones are usually located in the areas of heavy surplus production. The zones of successively higher prices tend to form more or less concentric circles about the zones of low prices. Freight charges and local demand are the most important elements contributing to the geographical variation of farm prices (*12*, *13*, *14*).[2]

[2] These three bulletins contain a detailed description of the geographic variations of farm prices of wheat, corn, and oats by counties.

FARM PRICE AND THE VALUE OF THE CONTAINER

The farm price is designed to express the general average of all sales made at a specified time in the locality in which the price reporter lives. If it is the local practice of the community for the farmer to sell potatoes in sacks or apples in boxes the farm price probably includes the cost of the container. A wide range of possibilities is included under the method of sale in different parts of the country. If marked differences exist between two States the farm prices of the farm product in question are not fully comparable. If local practices change over a period of several years, the farm prices lose some of their comparability. It is the local practice which determines what the farm price shall be in a particular section. The price of a single variety or grade would be misleading in years of light production or of heavy production of the particular variety.

UNIT OF MEASURE

The farm-price schedule of the Bureau of Agricultural Economics asks for the price of potatoes and sweet potatoes on both the bushel and 100-pound basis. The price of baled hay is asked separately so that the price of loose hay will not include prices of baled hay by mistake. The quotations are more likely to apply to a given unit of measure if a place is provided for the reporter to enter the price in the unit with which he is most familiar. It is a simple matter to convert the price of potatoes from the 100-pound basis to the bushel basis when the schedule is received. To obtain peanut prices accurately it is necessary to ask for the price in three different units—pound, bushel, and ton—depending on the variety of peanut sold and the part of the country from which the report comes.

FARM PRICES IN COMMERCIAL-PRODUCING AREAS

Because of the difficulties involved in having a State price based on both surplus-producing and deficit areas, and because of the wide differences in the prices of the different varieties of the same product, and the various units in which it is sold, the department is experimenting with special schedules for a few crops in the generally recognized commercial areas of several States.

Since about 1919 the department has been publishing the estimated values of commercial vegetable crops by States. These values are based on reports received every two weeks during the harvest season as to prices paid to growers, supplemented at the end of the harvest season by an inquiry as to the average price received during the season by growers. These values or season average prices do not include the prices of products sold from farm storage after harvest is completed.

For a number of farm products, such as turkeys, maple sugar, and peaches, farm prices are obtained only in the months in which the bulk of sales occur.

HISTORY AND METHODS OF COLLECTING FARM PRICES

Systematic collection of farm prices by the department began in 1867, when farm prices of crops and farm values of livestock as of January 1 were obtained from correspondents. In 1872 the date

for reporting prices of crops was changed to December 1. After this change was made it became customary to consider the crop prices reported as of January 1, 1867–1872, as equivalent to the prices prevailing one month earlier (December 1 of the previous calendar year), and for many years past these prices have been published as of December 1, 1866–1871, making a full series of December 1 prices for crops. No change has been made in the date for reporting values of livestock. The prices of crops and the values of livestock for the period, 1866–1878, as now published have been reduced to a gold basis, using equivalents supplied by the United States Treasury Department.

In January, 1908, the department began to obtain monthly prices paid to farmers for corn, wheat, oats, barley, rye, buckwheat, flaxseed, potatoes, cotton, and hay. The following February, butter, eggs, and chickens were added to the schedule. These prices were obtained as of the first of each month from crop reporters of the department. Beginning January, 1910, prices were collected as of the 15th of the month from a list of country dealers and merchants, for the following products: Hogs, beef cattle, veal, sheep, and lambs, per 100 pounds live weight; horses and milk cows per head; wool per pound; apples, pears, dry beans, sweet potatoes, onions, and clover seed, per bushel; and peanuts, per pound. Timothy seed and cottonseed prices were first obtained in September, 1910. Maple sugar and maple sirup prices date from March, 1912; alfalfa seed prices from June, 1912; prices of turkeys, per pound, from October, 1912. The prices of a few other farm products have been added from time to time.

Until 1925 there were three different lists of crop correspondents. The first corps of crop reporters built up by the department in the sixties was the "county correspondents." There was supposed to be one county correspondent in each county, who was to receive information from other reporters in his county. This was a small list, but the addresses were well distributed over the country. It was not until about 1896 that the township list was started. The township list, as its name implies, is supposed to have a reporter in every agricultural township.

As statistical agents were appointed in the field, each agent built up another list of correspondents—known as the "field aid" list—to report direct to him in the States which he covered. In 1900 there were three such field agents in the United States. The number was gradually increased until about 1910, when agents were appointed in the larger and more important agricultural States, and became known as State agricultural statistical agents or statisticians.

A year or so ago the list of county reporters was merged with the township list. At present there are about 38,500 township reporters and about 40,000 field-aid reporters. All reporters and correspondents of the department are doing the work voluntarily and receive no compensation for their services other than current publications of the department which contain the crop and livestock forecasts and estimates made by the department.

The 15th-of-the-month prices are reported by an additional list of about 13,500 voluntary correspondents, most of them country merchants, or dealers at country shipping points, and a few well-informed farmers. Prior to December, 1923, the prices of the major

crops were reported on the first of the month by farmers by the county reporters in connection with monthly crop reports. Beginning with December, 1923, all monthly prices are for the 15th of the month. The 1st-of-the-month prices for the period prior to December, 1923, have been converted to an approximation of a 15-of-the-month price by taking the average of the prices reported on the first of two consecutive months. The prices of livestocks have always been reported on the 15th of the month. For a few products prices had been reported both on the 1st and 15th. Whenever possible, the 15th-of-the-month prices have been used.

One would expect a greater lag upon the current prices at primary markets when the reporters are farmers than when they are dealers. A comparison of dealers' and farmers' reports on staple crops indicate that there is no great difference other than a slight lag. It is felt that the old and the new series of the monthly prices may be safely combined. Since March, 1913, all egg prices and since May, 1913, all chicken prices are those reported on the 15th of the month.

In several of the small States the change from crop reporters to country dealers and merchants marked the end of reports on prices of crops unimportant in those States, such as wheat in the New England States.

From about August, 1920, to November, 1922, the price reports were handled by the field statisticians. Prior to and since that period the price schedules have been sent from and returned to Washington.

In only two States—Missouri and Ohio—are price reports obtained from correspondents other than those who report to Washington. In each of these two States the results from the two inquiries are combined to obtain the prices published each month by the department. It is surprising how closely the results of these two separate inquiries in the same State check each month.

Both the December 1 crop prices and the January 1 livestock values are reported by the township list of crop reporters.

Beginning with the development of the field-aid list, the December 1 prices of crops and the January 1 values of livestock have been obtained from both the township and field-aid lists and the separate results combined in obtaining the State average published.

Beginning with 1867 the January 1 values of livestock have been obtained by asking the average value or price per head for all ages and sexes of a given kind of livestock. This method has been employed to date in reports on swine and milk cows, but beginning with 1894 the inquiry on horses, mules, sheep, and other cattle (as distinguished from milk cows) has been made on the basis of an age classification and, in the case of sheep, on the basis of a sex classification. The values as obtained for the different age groups were averaged to obtain the value per head of all the animals of a given kind—as horses. This change in the nature of the inquiry was undoubtedly an improvement, but the comparability of the series was somewhat disturbed.

In January, 1926, the value of swine was obtained in the old way, that of "swine of all ages" from some of the correspondents, and from the rest of them on the basis of three subclasses: (1) Sows and gilts bred or to be bred for spring pigs, (2) all other hogs 6 months old and over, including boars, and (3) pigs under 6 months old. When

the results of these two inquiries were compared for individual States, the average value of swine of all ages obtained by the old method was lower than that obtained by the subclass method. A similar comparison between the value of all cattle on the basis of the inquiry which has been used beginning with 1894 and the value as obtained by a more detailed subgrouping showed that the price obtained by the old method was higher than that obtained in the new way.

The source of the information and the wording of the inquiry[3] influence the price quotation. For example, the monthly price of horses, as determined from the reports of the regular price reporters of the department when they are asked for the "average prices paid to producers in your market," is usually considerable higher than the January 1 value obtained from the crop correspondents, who are

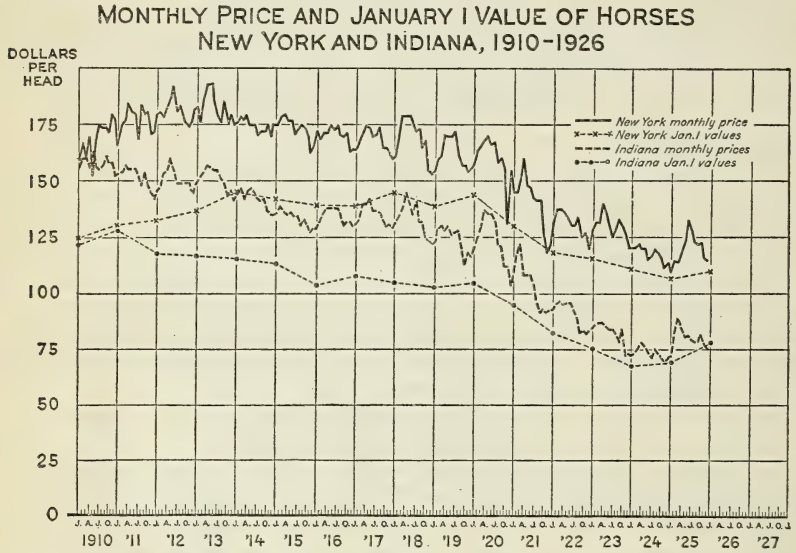

FIG. 1.—Both price series show the general downward trend of horse prices during the last 17 years, as well as the change in relationship between horse prices in the two States

requested to report the "average price per head of horses in your locality" by age groups. The 15th-of-the-month price represents more nearly the price at which horses were being bought and sold in a given locality and would tend to be higher than the January 1 price, which is really an estimate of the average value of all horses of a certain age on farms in that locality.

The same difference exists between milk-cow prices. Figures 1 and 2 show that while the monthly prices of milk cows and horses vary considerably and tend to have a seasonal movement, the general trend indicated by the series is practically the same as that of January 1 values.

[3] The price schedules now being used by the department may be obtained upon request addressed to the Division of Crops and Livestock Estimates, Bureau of Agricultural Economics, Washington, D. C.

AVERAGING AND WEIGHTING FARM PRICES

The problem of averaging farm prices is here divided for convenience into the averaging of price quotations or reports within the State to obtain a State average price, and the averaging of State prices in determining the United States average price. Another division which might be made is that of averaging price reports from different sections or areas as of a particular date, and averaging monthly prices to obtain an annual price either for the State or the United States. Averages may be any one of the three common types of averages: (1) The straight, simple, or unweighted average, which really gives the same weight to each price in the series; (2) the weighted average in which the same or "constant" weights are used time after time, and (3) the weighted average in which different or "current" weights are used each time.

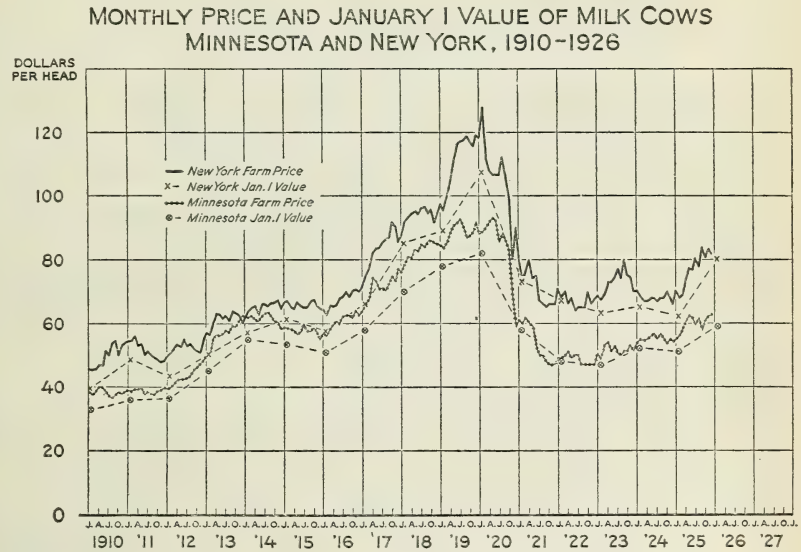

FIG. 2.—Both the monthly prices and the January 1 values measure the general relationship between milk-cow values in the two States for the 17-year period from January, 1910, to January, 1926

STATE PRICES

That the farm price may fairly well represent the average price received by producers, it is necessary that the samples be well distributed so as to represent both surplus-producing and deficit areas. When the schedules received are well distributed there is a general tendency for more reports to be received on the price of a certain product in those sections of the State in which the most sales occur; that is, in the surplus-producing sections. For weighting purposes, each State is divided into about 9 crop-reporting districts, as shown in Figure 3 (some small States have less than 9 and a few States have 10 crop-reporting districts). In determining the State farm price of an important crop the price reports from each district are averaged and these district averages are weighted by the number of

acres of that crop raised in each district the last year for which data are available.

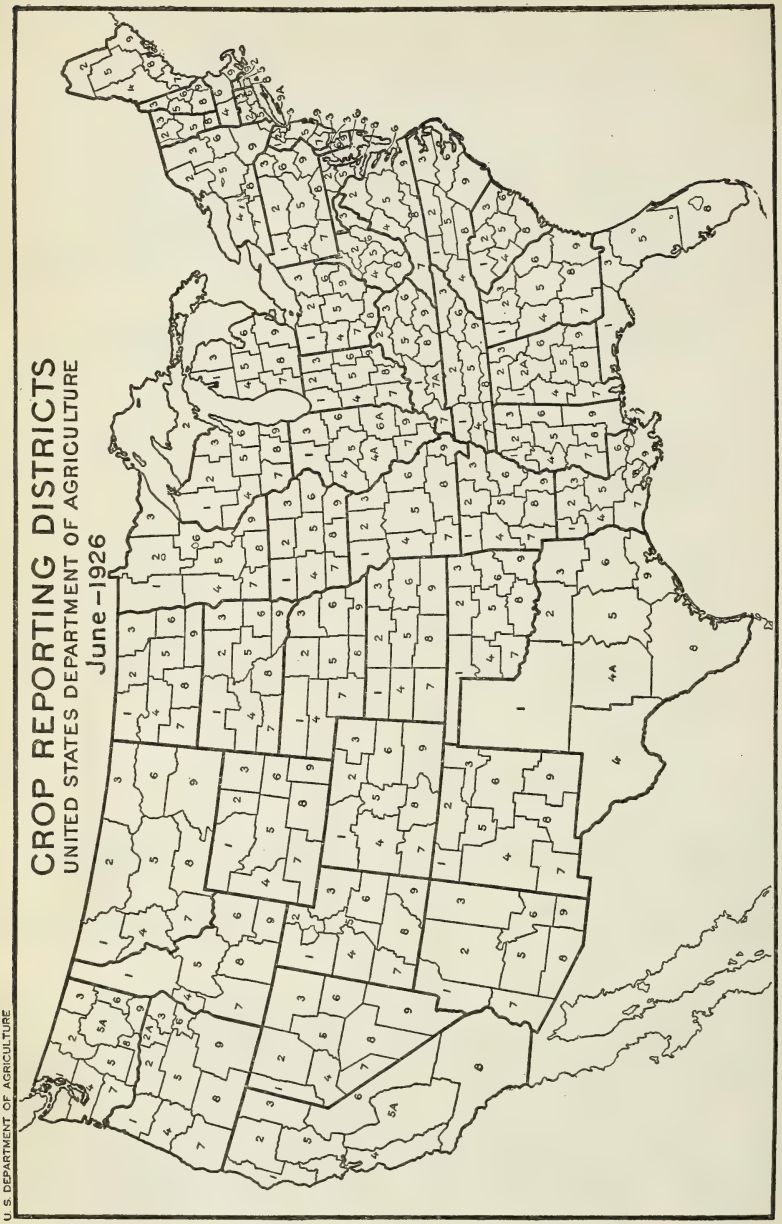

FIG. 3.—Location of the crop-reporting districts by States

In such States as Iowa, Kansas, and Wisconsin, where a yearly enumeration of acreage is made, the district weights are usually based on the preceding year's acreage. In many of the States the latest census acreage is used. Prior to 1924, when crop prices as of the 1st

of the month were obtained from crop reporters, the prices of crops were weighted by counties within the State, and the census acreage was used as a basis of weighting.

The prices of minor crops, of livestock, and of livestock products are averaged for the State—a straight average—the only weighting being whatever may result from having more reports from those parts of the State in which the sales of any particular product are most numerous.

UNITED STATES MONTHLY AND ANNUAL PRICES

In combining the farm prices for all States into a United States monthly farm price for each product, as released each month by the department, the State prices have been weighted according to the latest estimate of the production of each crop, in the case of crops, and according to the number of head of each class of livestock on farms January 1, in the case of livestock. Census production weights are used for livestock products and for such other products as can not be weighted as indicated above.

With crops, the December estimates of production by States are used as weights as soon after the estimates are made as possible, usually with the January prices. Since the December 1 prices are used in determining the December value of crop production by States and for the United States, the average value per unit of the United States production of a given crop is also the United States average price for December 1. The December estimates of production are used as "constant" weights for the ensuing year until the December estimates are again available unless there has been a marked shift in production, in which case a change in weights to the current year's estimated production is made at or about harvest time. When the January 1 estimates of livestock are used as weights, the new weights are used each year with the February monthly prices, as well as with the January 1 values of livestock per head.

This method lends itself readily to determining an average price for the United States each month as the prices become available. It has the disadvantage of giving a State the same weight each month of the year whether there are many sales during that month or only a few. In case no prices are reported from a given State in any particular month, only the prices and weights of the States reporting are used in determining the United States average.

The annual crop-year or calendar-year average price for the United States [4] is determined by weighting these monthly prices for the United States on the basis of the relative quantity of the crop usually marketed each month.

Farm prices are more like index numbers than like actual prices. When weights are used the price each month within the State is weighted by constant weights based on the acreage in the different crop-reporting districts within the State. The United States monthly prices within the year are weighted by constant weights based on the annual production of the different States, which change

[4] A price summary for the year with crop-year average prices for the United States since the monthly-price series began is published each year in the December issue of "Crops and Markets," for crops, and in the February issue for livestock and livestock products. Previous to 1927 these monthly issues were called "Supplements."

from year to year as relative production changes. The United States annual average price is weighted from year to year by constant weights based on the "usual" rate of marketings month by month, expressed as a percentage of the usual year's total marketings. In the following discussion this method of determining the average annual crop-year or calendar-year price for the United States will be known as method A.

A second method of obtaining an average annual price for the United States, which appears more logical than method A, is as follows and will be known as method B.

The United States annual crop-year average price is determined by averaging State annual prices, using the production or total sales by States as weights. The State annual prices are obtained by averaging the monthly prices for a given State, using the monthly percentage of each year's total marketings as weights. The weights from year to year are not constant, as the "current" marketings are used for each year. They can be determined only at the close of the crop year. A monthly United States price average can not be obtained with this method, as the State marketing weights are on a percentage basis only.

Method B involves more labor than method A and requires relatively more accurate information concerning monthly marketings than is now available on a State basis for most farm products. It would necessitate the determination of monthly marketing weights for each State, whereas now these weights are determined only for the United States as a whole. States with small production and very few sales influence the United States average very little, but averages for these marketings would be very difficult to obtain on a State basis with the methods now employed and the facilities now available. There is some question as to whether States which produce very little of a given farm product—not enough for their own needs—should be included in the United States average price. This production has a value and should be included in the total production and total value for the United States. It is also a factor influencing price, as it is a part of the potential supply. To disassociate ideas of price per unit from value of production is difficult. With cotton, however, no such question arises, as it is all sold from the farm.

A third method of weighting, called method C, to ascertin the annual average price for the United States is similar to method B, and will at the same time permit a monthly United States price to be obtained at the close of the year only and not from month to month as the season advances. The monthly percentages of each year's marketings by States are applied to the total quantity sold each year, and the quantity sold per month in each State is used as a weight. These weights can then be used month by month in working up the annual price for a given State, or State by State for the monthly price for the United States. In this way the monthly price in each State is weighted by sales in that month in determining both the State annual price and the United States monthly price, and in turn the United States annual average price.

Method C in reality gives a United States annual average price which closely approximates the average sale price for the product.

It does away with constant weights based on the usual rate of marketing, in determining the monthly United States price, as the State weights are based on sales within a given month and not on annual production. It eliminates the usual percentage of monthly marketings as a constant weight by using the actual marketings in terms of quantities by States and for the United States. What could be more logical than the use of actual marketings in terms of bales, bushels, or tons by months and by States as a basis for combining monthly prices to obtain annual prices, or for combining State prices to determine United States monthly or annual average prices?

In addition to requiring much more labor in compilation and greater reliability in the marketing data, it has this disadvantage that while a monthly United States price can be determined historically at the close of the season, it can not be determined currently from month to month, as can be done with method A, unless marketings are estimated from primary market receipts. Estimates of monthly marketings are not obtained from farmers until the close of the crop year and are then applied to the total sales for the year. It would be possible, however, to estimate farm marketings currently from monthly receipts at primary markets. This may be done by comparing monthly receipts at markets in the past with farmers' reports as to the quantities marketed monthly and taking into account variations in the size of the crop.

A fourth method of weighting, method D, is really a combination of the regular method A and the more refined methods B and C. The United States monthly price is obtained by weighting the State monthly prices by constant production weights, as in method A. The United States annual price is determined by weighting these monthly United States prices by current marketings for each year, as in methods B and C. By this method a monthly United States price is readily determined in the usual way month by month, and at the close of the year these monthly prices are weighted by the monthly marketings for that year. The monthly marketings are determined on a United States basis, thereby eliminating the difficulties of ascertaining monthly marketings on a State basis.

Cotton prices have been taken as a basis for comparing the results of these four different methods of weighting. Cotton is probably the most speculative American farm product. The American crop tends to dominate the world situation, and is undoubtedly the greatest single factor affecting the world price of cotton. The price of cotton is highly sensitive to changing conditions and is subject to as much variation in price and rate of marketing as any major farm product. Conclusions reached in a study based on cotton prices should be indicative of results that would be obtained with other farm products which are less speculative and variable, and on which less accurate data concerning production, marketings, etc., are available.

There is not as much difference between the results obtained by these different methods of weighting as might be expected. Table 1 gives a comparison of the United States monthly prices of cotton weighted by methods A and C. In the 15 years from 1910 to 1924, inclusive, there were 180 months, and this table gives comparisons of the prices in 174 of these months. In 71 months or about 40 per cent of the cases the monthly averages obtained by the two methods

were identical and in 153 months, or 88 per cent of the cases the difference between the results obtained by the two methods was not more than 0.2 cent. In only 7 months was the difference more than 0.5 cent, and in only 1 month in the 15 years was the difference more than 1 cent.

TABLE 1.—*A comparison of United States monthly farm prices of cotton weighted by methods A [1] and C [2]*

[Cents per pound]

Year beginning—	Method	Month												Annual average
		Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	
1910	A	14.4	13.8	13.6	14.0	14.2	14.4	14.1	13.9	14.0	14.4	14.5	13.8	14.0
	C	-----	13.8	13.6	14.0	14.2	14.3	14.1	13.9	14.1	14.5	14.5	13.8	14.0
1911	A	12.5	11.0	9.6	8.8	8.6	8.7	9.4	10.0	10.5	11.0	11.1	11.6	9.7
	C	-----	11.0	9.7	8.8	8.6	8.7	9.4	9.9	10.6	11.0	11.1	11.6	9.6
1912	A	11.6	11.2	11.0	11.4	12.0	12.0	11.8	11.8	11.7	11.6	11.6	11.6	11.5
	C	-----	11.2	11.0	11.4	12.1	12.1	11.9	11.8	11.7	11.5	11.5	11.6	11.5
1913	A	11.6	12.6	13.2	12.6	12.0	11.8	12.2	12.2	12.0	12.3	12.4	12.4	12.5
	C	-----	12.6	13.2	12.6	12.0	11.7	12.0	11.9	12.1	12.4	12.4	12.4	12.5
1914	A	10.6	8.2	7.0	6.6	6.7	7.0	7.4	7.8	8.6	8.8	8.6	8.4	7.4
	C	10.5	8.1	7.0	6.5	6.7	7.0	7.4	7.8	8.6	8.9	8.6	-----	7.4
1915	A	8.3	9.8	11.4	11.4	11.4	11.4	11.3	11.3	11.5	11.8	12.4	12.6	11.2
	C	8.4	10.0	11.4	11.5	11.4	11.5	11.3	11.3	11.5	11.9	12.4	-----	11.2
1916	A	13.6	15.0	16.8	18.8	18.4	17.0	16.4	17.0	18.4	19.6	22.4	24.5	17.7
	C	13.8	15.0	16.7	18.8	18.4	16.9	16.3	17.1	18.6	19.7	22.7	24.7	17.3
1917	A	23.8	23.4	25.3	27.5	28.3	29.3	30.0	31.0	30.2	28.0	28.0	28.2	27.2
	C	23.9	23.4	25.3	27.5	28.3	29.2	30.0	31.0	30.3	28.0	28.1	28.0	27.1
1918	A	30.0	32.0	30.6	28.4	28.2	26.8	24.4	24.2	25.2	27.8	30.3	31.8	28.8
	C	29.7	32.0	30.6	28.4	28.0	26.7	24.4	24.2	25.3	27.8	30.4	32.0	28.8
1919	A	31.4	30.8	33.9	36.0	35.8	36.0	36.2	36.8	37.5	37.4	37.3	37.1	35.0
	C	31.3	30.9	34.0	36.1	35.6	36.0	36.3	37.4	38.4	38.3	37.7	37.6	35.2
1920	A	34.0	28.3	22.4	16.6	12.7	11.6	11.0	9.8	9.4	9.6	9.7	9.7	17.2
	C	32.7	28.1	22.4	16.4	12.4	11.6	11.1	9.9	9.4	9.6	9.7	9.8	15.8
1921	A	11.2	16.2	18.8	17.0	16.2	15.9	15.7	16.0	16.0	17.3	19.6	20.6	16.9
	C	11.6	16.5	18.7	16.9	16.2	16.0	15.9	16.2	16.1	17.4	19.7	20.7	17.0
1922	A	20.9	20.6	21.2	23.1	24.2	25.2	26.8	28.0	27.6	26.2	25.9	24.8	23.5
	C	21.1	20.5	21.0	23.0	24.1	25.2	27.0	28.4	27.8	26.6	26.1	24.8	22.8
1923	A	23.8	25.6	28.0	29.9	32.1	32.5	31.4	27.7	28.7	28.1	27.8	27.3	29.0
	C	23.2	25.4	27.8	29.7	32.0	32.6	31.6	28.0	29.0	29.0	28.4	27.5	28.7
1924	A	27.8	22.2	23.1	22.5	22.2	22.7	23.0	24.5	23.7	23.0	23.0	23.4	23.0
	C	27.9	22.2	23.1	22.6	22.2	22.8	23.0	24.7	23.6	23.0	22.6	23.1	22.9

[1] Method A: The United States monthly price is obtained by averaging the State monthly prices, using estimates of annual cotton production by States as a basis of constant weights from month to month. The United States price is really an index price, as constant weights are used from month to month. This is the method used by the department at the present time.

[2] Method C: The United States monthly price is obtained by averaging the State monthly prices, using as weights an estimate of the quantity of cotton sold in each State in a given month. These weights are not constant from month to month. The United States price obtained in this way approximates the actual average price of cotton sold each month.

Table 2 gives a comparison of the four methods of weighting used in determining the United States annual crop-year price of cotton. For 9 of the 12 years in which a comparison of methods B and C is possible from the figures available, the annual averages are identical, and in no case does the difference exceed 0.2 cent. The results of the two methods should be practically identical, as in method B monthly marketings expressed as percentages of the year's marketings are used as a basis of weighting, and in method C the percentages are converted to actual quantities, i. e., bales.

TABLE 2.—*A comparison of United States annual crop-year prices, unweighted and weighted by methods a, b, c, and d, and annual State crop-year average prices of cotton*

[Cents per pound]

State	Crop year beginning in August—															15-year straight average
	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	
U. S. (A[1])	14.0	9.7	11.5	12.5	7.4	11.2	17.7	27.2	28.8	35.0	17.2	16.9	23.5	29.0	23.0	19.0
U. S. (B[2])	-----	-----	11.5	12.5	7.3	11.2	17.3	27.1	28.8	35.4	15.8	16.9	22.8	28.7	-----	-----
U. S. (C[3])	14.0	9.6	11.5	12.5	7.4	11.2	17.3	27.1	28.8	35.2	15.8	17.0	22.8	28.7	22.9	18.8
U. S. (D[4])	13.9	9.6	11.4	12.5	7.4	11.2	17.3	27.1	28.8	35.1	15.9	17.0	22.9	28.8	22.9	18.8
Va	14.0	9.9	11.6	13.0	8.1	11.6	17.6	28.3	28.0	35.2	14.6	16.6	23.4	30.3	22.7	19.0
N. C	14.1	9.4	11.6	12.7	7.7	11.2	17.4	27.6	27.8	35.6	14.8	17.0	24.1	29.2	22.6	18.9
S. C	14.0	9.5	11.7	12.9	7.8	11.2	17.6	27.4	29.2	36.3	16.0	17.4	24.6	28.8	22.8	19.1
Ga	14.0	9.6	11.6	12.9	7.5	11.3	18.0	28.0	29.4	35.7	16.9	17.3	23.7	29.7	23.0	19.2
Fla	18.6	13.0	14.6	15.0	12.4	14.8	24.5	45.9	41.8	36.1	16.4	16.2	20.9	28.6	23.5	22.8
Ala	14.0	9.5	11.4	12.9	7.3	11.1	17.7	27.4	28.8	34.9	15.9	16.9	23.3	29.6	23.1	18.9
Miss	14.1	9.8	11.9	12.6	7.3	11.5	18.2	27.7	28.2	36.2	15.4	17.0	23.5	31.1	23.4	19.2
La	14.0	9.6	11.4	12.2	7.6	10.9	16.8	26.4	28.6	35.8	16.8	15.8	22.5	27.7	22.0	18.5
Tex	13.8	9.9	11.3	12.2	7.2	11.0	16.6	26.0	29.5	34.4	17.3	16.8	21.9	27.8	23.0	18.6
Okla	13.4	8.9	11.1	11.8	6.8	11.1	17.0	25.8	27.4	35.0	12.8	16.4	21.5	28.1	22.3	18.0
Ark	14.1	9.3	11.8	12.1	7.1	11.6	17.6	28.0	28.1	35.3	13.7	17.2	23.3	29.8	23.1	18.8
Mo	13.1	9.3	10.4	11.6	6.9	10.9	17.0	27.8	27.2	31.9	13.3	15.7	21.4	28.7	23.4	17.9
Tenn	14.1	9.2	11.9	12.8	7.1	11.4	17.5	27.6	27.6	34.0	13.9	16.5	23.2	29.7	22.8	18.6

[1] Method A: The United States annual crop-year average price is obtained by averaging the United States monthly prices, using the usual monthly percentage of the year's marketings for the United States as a basis of constant weights from year to year. These constant weights based on the percentage usually marketed each month are determined from the United States 10-year averages. The United States monthly prices are obtained by averaging the State monthly prices, using estimates of annual cotton production by States as a basis of constant weights from month to month within the year. The United States annual price is really an index price as constant weights are used. This is the method now used by the department.

[2] Method B: The United States annual crop-year average price is determined by averaging the State annual prices, using the production or total sales of cotton by States as weights. The annual State prices are obtained by averaging the monthly prices for a given State, using the monthly percentage of each year's marketings as weights. A monthly United States price average can not be obtained by this method with the State marketing weights on a percentage basis.

[3] Method C: The United States annual crop-year average price is ascertained in the same way as by method B, except that the monthly percentage of each year's marketings by States is applied to the production of cotton and the estimated bales sold per month per State are used as weights. These bale weights are used in weighing State monthly prices to obtain the State annual average. A monthly United States price can be obtained by cross-adding each month the State average price times the number of bales sold and dividing by the total of the bales sold for that month. This was done in Table 1, where the United States monthly prices of cotton obtained by methods A and C are compared.

[4] Method D: The United States annual crop-year average price is ascertained by combining the United States monthly prices as obtained under method A by the use of monthly weights based on the current year's marketings by months for the United States. The current year's weights are used, as in method C, but for the United States as a whole and not by States.

It is extremely gratifying to note that the annual averages as ordinarily computed by the department by method A check so closely with the averages obtained by method C. In the 15 years from 1910 to 1924 the annual averages are identical for 6 years, and vary only 0.1 cent in 4 years. In fact, there are only 2 years out of the 15 in which the difference was more than a half cent.

The greatest difference occurred in 1920, when the price of cotton dropped from 34 cents per pound in August, 1920, to less than 10 cents by the end of the crop year . That was the year when cotton farmers held more than the usual amount of cotton until late in the season. The method A average was 17.2 cents, whereas the method C average was 15.8 cents, a difference of 1.4 cents. The method A average, being weighted by the usual rate of marketing cotton, month by month, has the early high-priced months weighted more heavily than when the actual marketings for the year were used. The only other year when the difference was greater than 0.4 cent was the crop year 1922–23. In that year the method A average was 23.5 cents, compared with 22.8 cents, the method C average, a differ-

ence of 0.7 cent. The early months of the 1922–23 season were the low-priced months (see Table 1), and the marketings were heavier than usual during these months; therefore, using the constant weights based on the usual rate of marketing would give a higher annual price average than would using as weights the actual marketings for that year. Table 3 gives a comparison of the constant percentage weights and the current marketings and percentage equivalents for the two crop years when the differences between the annual average prices were greatest, 1920–21 and 1922–23.

TABLE 3.—*Comparison of constant and current monthly cotton weights*

Month	Constant weights,[1] all years	Crop year 1920—21		Crop year 1922—23	
		Monthly marketings	Equivalent percentage	Monthly marketings	Equivalent percentage
	Per cent	*1,000 bales*	*Per cent*	*1,000 bales*	*Per cent*
August	3	403	3	502	5
September	12	1,296	10	1,657	17
October	20	2,152	16	2,472	25
November	20	2,092	16	1,916	20
December	14	1,464	11	1,207	13
January	7	847	6	571	6
February	5	745	5	423	4
March	5	795	6	360	4
April	4	885	7	200	2
May	4	925	7	94	1
June	3	880	7	142	1
July	3	763	6	151	2

[1] Based on usual or average percentage of the cotton crop marketed in each month.

In the two years when the differences between the A and C methods of determining the United States annual average prices were the greatest the actual rate of marketing did not correspond with the usual or average rate, which is used as a basis for the constant weights in method A. If the monthly United States prices obtained by method A are weighted by the actual marketing rates used in method C—the procedure called method D in Table 2—the difference of 1.4 cents between the A method and the C method averages in 1920 is reduced to 0.1 cent, and the difference of 0.7 cent in 1922 is reduced to 0.1 cent. In Table 2 the comparison of the results obtained by using methods C and D show that for 9 of the 15 years included in the table the results are identical, and in no year did the difference exceed 0.1 cent.

Apparently the difference between the results obtained with method A, the method now generally used with farm prices, and method C, which is a much more logical and refined method, arises from the method of constructing the monthly marketing rates rather than from the State weights used in determining the United States monthly price. The small differences between the monthly prices as determined by the two methods, as shown in Table 2, seem to be largely compensating differences when the monthly prices are combined to obtain the annual price for the United States, when current rates of marketing month by month are used rather than constant weights based on the usual or average rate of marketing.

In estimating an annual price for the United States prior to the determination of the current year's rate of marketing at the close of the year, it would be necessary to use constant weights based on marketings until the current marketings are available, unless the current marketings are estimated on the basis of market receipts.

UNWEIGHTED VERSUS WEIGHTED AVERAGES

The use of an annual United States average price brings up the question as to the difference between results obtained by using a straight or unweighted average of the United States monthly prices and those obtained by using a weighted average. The problem of the weighted average resolves itself into a comparison of weights based on the usual or average rate of marketing month by month and the actual or current rate of marketing in a given year. Table 4 shows a comparison of the results obtained over a period of years in averaging the regular United States monthly prices of wheat and of cotton for the year, using constant or usual weights, current weights, and no weights.

TABLE 4.—*A comparison of United States annual farm prices of wheat and cotton, unweighted and weighted, by constant and current year marketings*

[Wheat—cents per bushel. Cotton—cents per pound]

Crop year beginning—	Crop-year average price of cotton			Crop-year average price of wheat		
	Unweighted or straight	Constant weights [1]	Current weights [2]	Unweighted or straight	Constant weights [1]	Current weights [2]
1908				99.9	95.6	94.8
1909				101.6	101.3	100.7
1910	14.1	14.0	13.9	89.6	91.3	91.7
1911	10.2	9.7	9.6	90.9	88.9	88.3
1912	11.6	11.5	11.4	82.4	83.2	83.3
1913	12.3	12.5	12.5	80.5	79.5	79.3
1914	8.0	7.4	7.4	110.3	102.8	99.4
1915	11.2	11.2	11.2	99.7	98.8	98.2
1916	18.2	17.7	17.3	167.0	152.2	144.4
1917	27.8	27.2	27.1	205.5	206.8	205.8
1918	28.3	28.8	28.8	211.1	208.1	206 3
1919	35.5	35.0	35.1	227.7	221.6	218.6
1920	15.4	17.2	15.9	166.4	181.8	182.9
1921	16.7	16.9	17.0	105.6	103.1	104.4
1922	24.5	23.5	22.9	100.9	98.7	98.0
1923	28.6	29.0	28.8	94.5	93.2	92.4
1924	23.4	23.0	22.9	140.0	133.8	127.8

[1] Constant weights based on usual rate of monthly marketing.
[2] The United States monthly prices as regularly determined by method A, weighted by current year monthly marketings.

When the price of a given product does not change materially from month to month throughout the year, that is, when the price movement is said to be a horizontal one, it makes little difference how the average is weighted, as the results are practically the same. In the years 1910, 1912, 1913, and 1915 cotton prices showed little change, and the resulting averages are all within 0.1 or 0.2 of a cent of each other. A somewhat similar situation existed with wheat prices (see Table 4) in the years 1909, 1912, 1913, 1915, and 1917.

TABLE 5.—*Monthly farm prices of wheat, 1908–1925*

[Cents per bushel]

Year beginning—	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Jan. 15	Feb 15	Mar. 15	Apr. 15	May 15	June 15	Weighted average [1]
1908	90.0	89.6	89.6	91.0	92.2	93.2	94.4	99.6	105.4	111.4	119.7	122.2	94.8
1909	114.0	101.2	94.9	97.2	99.2	101.0	104.2	105.0	104.8	102.2	98.8	96.4	100.7
1910	97.1	97.4	94.8	92.1	89.4	88.4	89.2	87.6	84.6	84.2	85.4	85.3	91.7
1911	83.5	83.8	86.6	90.0	89.4	87.7	89.2	90.6	91.6	96.1	101.2	100.9	88.3
1912	94.4	87.8	84.6	83.6	79.9	76.1	78.0	80.2	79.8	80.0	81.8	82.0	83.3
1913	79.2	77.1	77.5	77.4	78.4	80.4	81.3	82.4	83.6	84.0	84.2	80.6	79.3
1914	76.7	84.9	93.4	95.4	97.9	103.2	118.8	131.8	132.6	135.6	135.6	117.2	99.4
1915	104.6	100.8	93.0	92.0	92.5	97.4	108.4	108.4	100.8	100.6	101.2	96.5	98.2
1916	100.0	119.2	133.8	147.4	159.4	155.3	157.6	164.6	172.2	213.0	247.2	234.3	144.4
1917	224.5	219.3	205.2	200.3	200.4	201.4	201.6	202.0	202.6	203.1	203.0	202.8	205.8
1918	203.8	205.0	205.7	205.9	205.1	204.5	206.2	207.8	211.1	222.6	229.8	225.2	206.3
1919	219.6	211.4	207.6	211.4	214.0	223.4	233.8	231.2	230.3	242.6	250.8	256.0	218.6
1920	242.9	225.4	216.5	201.2	165.8	146.4	149.2	148.2	140.4	122.1	119.0	119.8	182.9
1921	108.5	103.0	103.4	99.9	93.4	93.0	95.2	107.0	117.0	119.0	118.8	109.6	104.4
1922	99.8	92.6	89.2	94.1	99.4	103.2	104.6	104.4	106.0	108.4	108.2	100.8	98.0
1923	89.6	86.4	91.0	94.2	93.7	94.5	96.7	98.0	98.8	95.8	96.8	98.5	92.4
1924	105.8	116.8	114.2	129.7	133.6	141.1	162.1	169.8	164.0	140.5	149.1	152.7	127.8
1925	140.3	150.4	144.4	136.4	148.8	153.7	158.1	155.5	146.0	142.2	142.1	138.9	145.9

[1] The United States monthly prices as regularly determined by method A weighted by current-year monthly marketings.

When the price trend of a given product is generally upward throughout the year, the straight or unweighted average which really gives equal weights to all months, will be higher than the average weighted either by current or usual rates of marketing the crop. The months of higher prices, coming during the last half of the year, when marketings are smallest, are given equal weight in a straight average with the earlier, low-price, months of heavy marketing, thereby making the straight average higher than either of the weighted averages. The trend of cotton prices in 1916, 1917, 1919, and 1922 was generally upward, and the straight average was from 0.4 cent to 1.6 cents higher than the weighted averages in those years. The same was generally true with wheat prices for the crop years 1914, 1916, 1919, and 1924.

When the price trend is downward instead of upward the reverse is true, and the straight average is less than either of the weighted averages. Declining prices for cotton and wheat in 1920 resulted in the straight averages being lower than either of the weighted averages.

With more years of rising than falling prices during this period, the straight averages of both cotton prices and wheat prices tend to be slightly higher than either of the weighted averages. The weighted-average price based on constant or usual weights tends to be higher than the one based on current-year weights. Apparently there is a tendency for the price to be depressed in a given month if more than the usual proportion of the year's sales occur in that month.

If weights based on actual marketings during a certain year are used instead of weights based on the usual rate of marketing, there will be heavier weighting in the low-price months, and consequently the annual weighted price will be lower when the current year weights are used. The straight average would also tend to be higher

than the weighted average, as it gives equal weight to all months whether marketings be lighter or heavier than usual; the months of small marketings and higher prices would have the same weight as months in which marketings were heavier and prices usually lower. This may not be the case in all years, as the price is determined by factors other than domestic supply. An unusual turn in the foreign supply and demand or in price level might make the lowest prices occur in the months when the marketings were not unusually heavy.

With wheat prices for example (see Table 5), the greatest differences appear in the crop year 1916–17, when the straight average was 167 cents, the price weighted by constant weights was 152.2 cents, and the price weighted by current weights was 144.4 cents. The monthly price of wheat in that year increased from 100 cents in July to 247.2 cents by the next May, and wheat was marketed more rapidly than usual. The only other year of any considerable difference between all three averages was 1924–25, when the price varied from 105.8 cents in July to as high as 169.8 cents in February, and again the wheat was marketed more rapidly than usual. Current weights gave heavier weighting to the low-price, early months of the year than did constant weights or the straight average, with the result that the current weighted average was 127.8 cents; using constant weights gave 133.8 cents; and the straight average was 140 cents. In the 1920–21 crop year the straight average was 166.4 cents, which was much lower than the weighted averages, which were about 182 cents. The price of wheat in that year dropped from 242 cents in July to 119 cents by the next May. The straight average, giving equal weighting to all months, was much lower than the weighted averages, in which the monthly prices were weighted by either constant or actual marketings for that year, which gave much heavier weighting to the early months when the price was highest. Even with falling prices farmers marketed their crops a little earlier than usual; consequently the current weighted price was the highest.

As a result of this analysis the United States monthly prices will continue to be obtained as they are being obtained at the present—constant production weights for States being used month by month; and the annual United States average price will be computed on the basis of current marketings by months rather than constant or usual marketings. In most years it will make little difference, but in exceptional years, the method of using current weights will take care of the unusual variations as they occur. United States prices of wheat are now on this basis, and so computed, were published in the December, 1925, Supplement to Crops and Markets, (*10*).

Ten-year averages of monthly marketings of corn, wheat, oats, barley, rye, flaxseed, hay, and cotton, on a percentage basis by States and for the United States appear on pages 114 and 115 of the April, 1925, Supplement to Crops and Markets (*6*). Car-lot shipments of fruit and vegetables, with some adjustments for products moving from dealers' hands, can be used as a basis for monthly marketings of such products. Inspected slaughter and receipts of livestock at public stockyards and packing plants will show approximately the monthly marketings of livestock. Receipts of butter, eggs, and chickens at important markets indicate the seasonal movement of such products.

ANALYSIS OF THE FARM-PRICE SAMPLE

Is the State farm-price average, obtained by the method of sampling used by the department, representative of the great variety of conditions existing within an area as large as a State? Assuming that the sample is fairly representative of the various price zones within the State, is the average of the sample reliable? Does a drop in the average price of wheat for Kansas signify that wheat is selling for 5 cents less, or is the change in the average due to changes in the composition of the sample, commonly known as "fluctuations in sampling"?

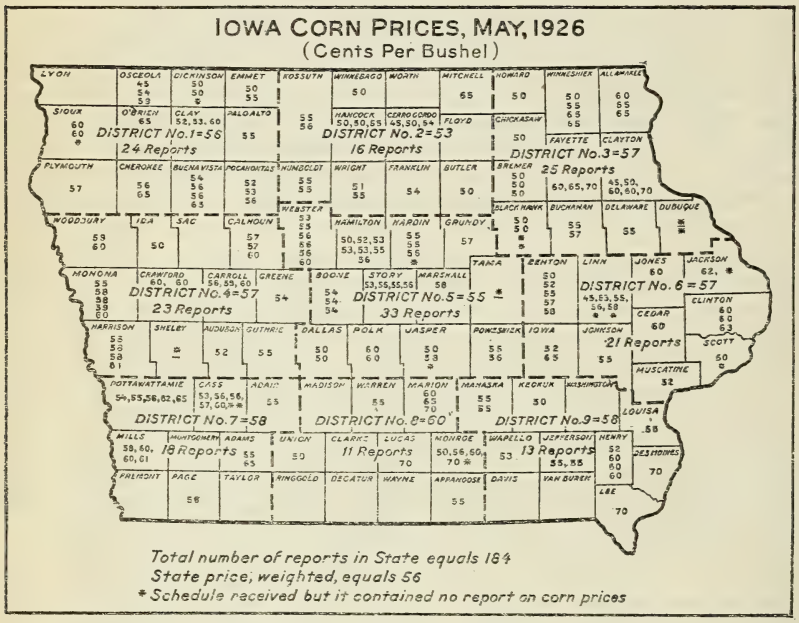

FIG. 4.—Distribution of reports on Iowa corn prices for May, 1926. Prices were received from about 80 per cent of the counties. The surplus-corn counties were well represented

GEOGRAPHICAL REPRESENTATIVENESS OF THE SAMPLE

Certain variations in the price of a given farm product are to be expected. A fully representative sample should include price reports from the different parts of the State where these variations occur. Figure 4 shows the distribution of the reports for May, 1926, on corn prices in the various counties of Iowa.

Prices were received from 80 per cent of the counties. In a year like 1925–26, in which the corn crop was large, a much larger proportion of the counties are surplus-producing counties than in a year like 1924, when the corn crop was short. Also the difference between the prices in surplus-producing and deficit counties is much smaller in actual amount, but remains about the same proportion of the lower average price.

More reports than were necessary were received from several of the counties. If the reports from half or two-thirds of the counties

had been discarded at random the remaining reports would have represented the State fully as well as the total number, and the resulting average would not have differed materially from the present average.

The results of the June 15, 1925, questionnaire as to the price received by producers of corn in the nine crop-reporting districts of Iowa are shown in Table 6. In 59 of the 83 replies the prices given were on even 5-cent intervals, that is, were round numbers such as 95, 100, 105, or 110 cents. The lowest prices were reported from those districts from which the most corn is usually sold, as for example, from districts 1, 2, and 5. The highest prices prevailed in districts 3 and 8, where corn is ordinarily shipped in at some time during the season. Sixty-four of the 83 replies were between 95 and 105 cents both inclusive. The straight average price for the State was 103.3 cents as compared with the weighted average, 103.1 cents. The closeness of the straight average to the weighted average indicates that the reported prices as received tended to weight themselves; that is, a larger number of price reports were received from the more important corn districts.

TABLE 6.—*Prices received by producers of corn in the State of Iowa, June 15, 1925*

DISTRIBUTION OF REPLIES

Cents per bushel	District 1	District 2	District 3	District 4	District 5	District 6	District 7	District 8	District 9	State
92					1					1
93										
94										
95	1		1			1				3
96				2						2
97	1	1								2
98	1	1			1					3
99				1	2					3
100	7	1	1	5	5	2	3	2	3	29
101										
102				2		1				3
103			1	1	3		1		1	7
104				1	1					2
105		2		1		4	1	1	1	10
106										
107										
108										
109										
110		1		3	1	1	2	2		10
111										
112										
113										
114										
115			2			1			2	5
116										
117										
118									1	1
119										
120			1					1		2
Total	10	6	6	16	14	10	7	6	8	83

AVERAGES, IN CENTS PER BUSHEL

	99	102	108	102	101	104	104	108	107	103.3

TABLE 6.—*Prices received by producers of corn in the State of Iowa, June 15, 1925*—Continued

RELATIVE WEIGHTS

Cents per bushel	District 1	District 2	District 3	District 4	District 5	District 6	District 7	District 8	District 9	State
	15	10	8	16	16	10	10	7	8	100

Straight average for State	103.3 cents.
Standard deviation for State	5.8 cents.
Coefficient of variability [1]	5.6 per cent.
Probable error of average [2]	.4 cent.
Relative probable error [3]	.4 per cent.
Weighted average for State	103.1 cents.

[1] The standard deviation expressed as a percentage of the average.

[2] The probable error of the average is equal to 0.6745 times the standard deviation of the series or array, divided by the square root of the number of reports; or $P.E._{average} = 0.6745 \frac{\sigma}{\sqrt{N.}}$

[3] The probable error of the average expressed as a percentage of the average.

The weighting of crop prices by crop-reporting districts is a device which aids materially in obtaining a representative average for the State. In case only a few reports are received from an important producing district they are given their proper influence on the State average when weighed by the importance of that district.

Table 7 shows the distribution of hay prices in Indiana by crop-reporting districts. Weighting the district prices undoubtedly increased the reliability of the State average.

TABLE 7.—*Prices received by producers of hay in the State of Indiana, June 15, 1925*

DISTRIBUTION OF REPLIES

Price, dollars per ton	District 1	District 2	District 3	District 4	District 5	District 6	District 7	District 8	District 9	State
6					1					1
7										
8				1		1			1	3
9		1	1							2
10		1		1	3	1		4	1	11
11			1							1
12	1		1				4	4	1	11
13										
14		1								1
15							1	1		2
16							1		1	2
17		1					1	1		3
18				1			1			2
19										
20	1						1	1		3
Total	2	4	3	3	4	2	9	11	4	42

AVERAGES, IN DOLLARS PER TON

	16.00	12.50	10.67	12.00	9.00	9.00	14.89	12.73	11.50	12.48

RELATIVE WEIGHTS

	8	12	15	10	17	7	13	9	9	100

Straight average for State	$12.48
Standard deviation	$3.55
Coefficient of variability [1]	per cent 28.4
Probable error of the average [2]	$0.37
Relative probable error [3]	per cent 3.0
Weighted average for State	$11.86

(See Table 6 footnotes.)

Table 8 shows the distribution of December 1, 1925, cotton prices in Texas as given by the crop correspondents reporting to Washington. The Texas agricultural statistician received a similar sample of price reports. With a large number of reports well distributed, there is a marked tendency for the largest numbers of reports to be received from those sections where the most sales are being made. More reporters are informed concerning the price of an important commodity than of an unimportant one. If price reporters are well distributed over a State, there is a marked tendency for the prices reported to be largely self-weighting.

For several different months a check was made State by State to determine the total number of counties in the State, whether agricultural or nonagricultural, represented by one or more reports or schedules. In September, 1925, there were 34 States in which 50 per cent or more of the counties were represented by one or more price schedules; in November, 1925, 33 States; in January, 1926, 37 States; and in March, 1926, 43 States. In a few States every county was represented. In March, 1925, the percentage of the total number of counties from which one or more schedules were received varied in the North Atlantic States from 100 per cent in Maine and New Hampshire to 71 per cent in New Jersey. The range in the North Central States was from 9 per cent in Ohio, 10 per cent in Indiana, and 11 per cent in Wisconsin and Kansas, to 63 per cent in Missouri.[5]

TABLE 8.—*Analysis of prices received by producers of cotton in the State of Texas, December 1, 1925, by crop-reporting districts*

NUMBER OF REPORTS AT SPECIFIED PRICES

Price, cents per pound	District 1	District 2	District 3	District 4	District 4a	District 5	District 6	District 8	District 9	State
12	2		1					1		4
13	4					1				5
14	12	4	2			2	1			21
15	7	2	4			5	7	1	1	27
16	12	7	5			4	4	1		33
17	8	4	4		2	7	7	5		37
18	19	27	20	2	6	26	9	17	6	132
19	6	13	10	5	13	15	5	14	4	85
20	10	27	17	5	31	44	12	13	10	169
21	1	6	3	2	3	8	2	3	2	30
22	2	7	4	1	3	5	6	2	1	31
23		1				2		1	1	5
24								2		2
25		1						1		2
Total	83	99	70	15	58	119	53	61	25	583

STRAIGHT (SIMPLE) AVERAGE PRICE, CENTS PER POUND

	16.8	18.9	18.4	19.7	19.6	19.0	18.4	19.1	19.4	[a] 18.6

STANDARD DEVIATION, CENTS

	2.35	2.08	2.05	1.16	1.03	1.86	2.18	2.05	1.56	2.10

[a] The weighted average price for the State is 18.4 cents per pound.

[5] In both Ohio and Missouri the State agricultural statistician receives reports on prices from a list of reporters at least twice as large as the list which reports to Washington. The returns from both lists are combined in making up the price reports for those two States.

TABLE 8.—*Analysis of prices received by producers of cotton in the State of Texas, December 1, 1925, by crop-reporting districts*—Continued

Price, cents per pound	District 1	District 2	District 3	District 4	District 4a	District 5	District 6	District 8	District 9	State
COEFFICIENT OF VARIABILITY, PER CENT										
	14.0	11.0	11.1	5.9	5.3	9.8	11.8	10.7	8.0	11.3
PROBABLE ERROR OF THE AVERAGE PRICE, CENTS										
	0.17	0.14	0.17	0.20	0.09	0.11	0.20	0.18	0.21	0.06
RELATIVE PROBABLE ERROR OF THE AVERAGE, PER CENT										
	1.03	0.74	0.89	1.02	0.46	0.61	1.10	0.93	1.10	0.43

(See Table 6 footnotes.)

In the South Atlantic States Delaware headed the list, with reports from 100 per cent of the counties, and Florida came last with reports from about 30 per cent. In the South Central States the range was from 82 per cent of the counties in Tennessee to only 34 per cent of the parishes in Louisiana, whereas in the far Western States the variation was from 80 per cent of the counties in Arizona to 24 per cent of those in Nevada. About two-thirds of all the counties in 29 States were represented by one or more reports; 20 of these States were in the North Central or Eastern States; 6 were Southern States, and 3 were in the far West. In some of the Southern States, in Georgia, for example, counties are very small units. In many of the Western States comparatively few counties are agricultural.

VARIABILITY AND SIZE OF SAMPLE

State price averages apply to large areas and dissimilar conditions. It has been pointed out that farm prices tend to align themselves in zones somewhat similar to belts of rainfall. Freight rates, transportation facilities, accessibility, lack of timely knowledge of market conditions and prices, surplus and deficit production, and differences in grade, quality, variety, age, and condition, are some of the factors that cause variation in the prices reported from different sections of a State. The farm prices of some products are much more variable than those of others.

With some idea of the variability in a price sample, or the dispersion of the individual price reports, it is possible to tell how many reports are necessary to obtain a given degree of reliability or stability in the average. The greater the variability, the greater number of reports needed to give stability to the average of the sample.

On analysis it is found that the farm prices of wheat, corn, cotton hogs, butter, eggs, and wool, seldom show a coefficient of variability,[6]

[6] The most common measure of the variability in a given sample is probably the standard deviation. It measures the range from the average within which approximately two-thirds of the reported prices will fall, assuming a normal or bell-shaped distribution. When the standard deviation is expressed as a percentage of the average, it is known as the "coefficient of variability."

of more than 10 per cent in States of surplus production. Oat prices in Missouri, Illinois, and Indiana for June, 1925, showed a coefficient of variability of 11.7, 11.9, and 11.6 per cent. The prices of all hay, milk cows, and horses are much more variable, with coefficients of variability ranging from 25 to 30 per cent or more.

The prices of many farm products are much more variable in Southern States than in Northern States. Coefficients of variability of Georgia prices in November, 1925, were: Corn, 19 per cent; sweet potatoes, 32 per cent; eggs, 14 per cent; and chickens, 18 per cent—all nearly three times as large as the same products in Northern States. On the other hand, variability of hay prices was about the same in Georgia as in New York or Indiana, and the same was true of prices of milk cows.

The next step is to measure the relative reliability of the average of the same sample when the variability and the number of reports are known. The probable error of the average mean is used for this purpose. This is found by dividing the standard deviation of the sample by the square root of the number of reports and multiplying by 0.6745. The probable error signifies that the chances are 50 out of 100 that the average of an indefinitely large sample collected in the same way as the given sample would not vary more than the amount of the probable error from the average of the sample we have. Owing to the probabilities of sampling the chance of an average being more inaccurate than four times its probable error is but 1 in 100. To compare the probable error of various price samples, a new statistical term has been improvised known as the "relative probable error." It is obtained by expressing the probable error as a percentage of the average, just as the coefficient of variability is the standard deviation of the sample expressed as a percentage of the average.

The probable errors of hog prices per 100 pounds in Iowa for several different months during 1924 and 1925 were as low as 3 cents in one month and as high as 9 cents in another. It is customary to round the hog prices to the 10-cent interval. The relative probable error for these samples ranged from 0.3 to 0.9 per cent. The relative probable error of the Kansas wheat price in October, 1924, with only 35 reports, was 0.7 per cent; in June, 1925, when there were 106 reports, it was 0.3 per cent; that of the price of eggs in Nebraska in May, 1925, with 118 reports, was 0.4 per cent; that of the price of South Carolina cotton in October, 1924, with 40 reports was 0.6 per cent. In other words, the chances are 99 out of 100 that the average of a larger sample taken in the same way as this one would have been within 2 per cent of the one obtained, or four times the relative probable error of 0.5 per cent.

If we take 0.5 per cent relative probable error or 2 per cent (four times the relative probable error) as our goal of desired accuracy, or reliability, how many reports will be necessary with samples of different variability? With a coefficient of variability of 5 per cent, about 45 reports would be necessary to obtain a relative probable error of 0.5 per cent; with a coefficient of variability of 10 per cent, about 180 reports would be necessary; with a coefficient of variability of 20 per cent, about 730 reports would be necessary and with a

coefficient of variability of 30 per cent, 1,640 reports would be necessary to obtain a relative probable error of 0.5 per cent. If we are willing, however, to be content with a relative probable error of about 2.5 per cent, or practical certainty within a range of 10 per cent (four times the probable error) for the prices of the less important crops, or crops of minor importance within a State, a small number of reports will be sufficient. Even when the coefficient of variability is 30 per cent, a 64-report sample will give a probable error of 2.5 per cent.

ANALYSIS OF PRICES OF FARM CROPS

The succeeding tables (Tables 9 to 22) show the number of reports, the average price, the standard deviation of the reports, the coefficient of variability, the probable error of the average price or mean, the relative probable error, and four times the relative probable error of several samples of farm-price data for a number of farm crops for various States.

For the sake of comparison, prices of all of the farm products shown have been considered on the basis of random or simple sampling, with a straight, unweighted average for each State. The probable error of the weighted average would be larger than the probable error of the straight average of a sample of the same size. On the other hand, the probable error of the average used is reduced by the fact that the sample is selected by crop-reporting districts and counties (*11, p. 349*), (*3, p. 316, 337*).

WHEAT

Table 9 shows a comparison of the size of the wheat-price sample, the dispersion, variability, and probable error of the average price obtained for several different States. This table includes the December 1 price for Kansas and Maryland as obtained from crop reporters on the township list, and for Kansas the value per bushel of the 1924 crop of wheat whether sold or to be sold, by crop-reporting districts, as determined from a special inquiry,[7] addressed to the township and field-aid lists of crop reporters.

The price of wheat shows as little variability as the price of any other farm product. In an ordinary year there is not a wide range of prices in a winter-wheat State like Kansas. Freight rates, quality, and protein content are important factors causing variation in the price reports received. In a State like North Dakota, where the durum wheat is on an export basis and the other spring wheat is on an import basis, as was the case in the 1925–26 season, there may be a very wide range in prices. In reality, the sample shows two modes, one for the durum wheat and one for other wheat.

[7] Part of a special-price inquiry made by the department in March, 1925, in all States on crops, livestock, and livestock products. The prices or values determined from this inquiry were furnished to the Bureau of the Census for use in evaluating the production of 1924 by counties. Farm prices are not regularly obtained on a scale warranting publication for smaller units than a State. The complete series by crop-reporting districts obtained in this special inquiry is given in Statistical Bulletin 14–17. For crops, correspondents were asked to report the average value or price per unit for the season, whether sold or to be sold.

TABLE 9.—*Farm prices of wheat: Selected illustrations of size of sample, measures of dispersion, and probable errors*

State, date, and district	Number of reports	Average price (arithmetic mean)	Standard deviation of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error [1]
		Cents per bushel	*Cents per bushel*	*Per cent*	*Cents per bushel*	*Per cent*	*Per cent*
Kansas:							
October, 1924	35	122.0	8.0	6.7	0.9	0.7	2.8
April, 1925	120	141.0	11.0	7.8	0.7	.5	2.0
June, 1925	106	150.0	8.0	5.3	.5	.3	1.2
Pennsylvania:							
October, 1924	30	135.0	18.4	13.6	2.3	1.7	6.8
April, 1925	13	155.0	7.0	4.5	1.3	.8	3.2
Utah, November, 1925	23	128.0	13.5	10.6	1.9	1.5	6.0
Maryland:							
March, 1926	36	164.5	8.7	5.3	1.0	.6	2.4
Dec. 1, 1925 [2]	119	150.7	11.4	7.6	.7	.5	2.0
Kansas, Dec. 1, 1925 [2]	655	147.2	8.4	5.7	.2	.1	.4
Kansas, 1924, by crop-reporting districts:							
1	77	[3] 119.0	12.9	10.8	1.0	.8	3.2
2	108	[3] 122.8	15.3	12.4	1.0	.8	3.2
3	84	[3] 125.5	16.6	13.2	1.2	1.0	4.0
4	50	[3] 119.7	17.1	14.3	1.6	1.3	5.2
5	89	[3] 120.3	11.8	9.8	.8	.7	2.8
6	89	[3] 119.5	18.9	15.8	1.3	1.1	4.4
7	50	[3] 122.1	14.9	12.2	1.4	1.1	4.4
8	102	[3] 119.8	13.2	11.0	.9	.8	3.2
9	94	[3] 121.3	16.9	13.9	1.2	.9	3.6
State	743	[3] 121.1	15.4	12.7	.4 [4] 0.377 [5] 0.398	.3 [4] 0.312 [5] 0.330	1.2 [4] 1.25 [5] 1.32

[1] The probabilities are ninety-nine out of one hundred that the average of a much larger sample collected in the same way and at the same time would not vary from this average by more than four times the probable error.

[2] These December 1 prices were reported by crop reporters and not by the regular price reporters, who report on the 15th of each month.

[3] Average value of entire 1924 crop, per bushel, whether sold or to be sold when the inquiry was made by the department in March, 1925.

[4] Applies to the straight average: Computed to three decimal places to show the difference from the figure for the average given above which is computed to only one decimal place, and from the figure for the weighted average below it.

[5] Applies to the weighted average: Computed to three decimal places to show the difference from the rounded figure and from the figure for straight average above it.

Generally speaking, however, the coefficient of variability of wheat prices is usually less than 10 per cent. With a sample of only 36 reports in Maryland for March, 1926, the relative probable error of the average was only 0.6 per cent. The probabilities are ninety-nine out of one hundred that a much larger sample collected in Maryland in the same way and at the same time would not vary by more than 2.4 per cent (four times the relative probable error) from the average obtained. In a State like Kansas, with 100 or more reports, four times the probable error is 2 per cent or less. The larger number of reports as to December 1 prices reduces the probable error of the aveage to a point where four times the probable error is only 0.4 per cent for Kansas and 2 per cent for Maryland.

The prices or value of the Kansas wheat crop as determined near the close of the crop year (in March, 1925), when the reporter was asked to estimate the average price for the season, have about twice the variability of a monthly price. This greater variability is to be expected, as a monthly price is affected by variations in different parts of the State on a given date, whereas the season price covers variability owing to changes in prices over a period of several months. The monthly price might be said to have variability in

two dimensions—quality and location—whereas prices for a season would be subject to variations in a third dimension—time. The relative probable errors of prices for crop-reporting districts average about 1 per cent. The relative probable error of the price for the State as a whole is very small—0.312 per cent—because of the large number of reports, namely 743.

A highly interesting comparison was made of the relative probable errors of the straight (unweighted) average and the weighted average of Kansas wheat prices during a crop year, 1924–25. As stated previously (p. 26), the probable error of the weighted average (*3, p. 317*) is greater than that of the unweighted average. This advantage of the unweighted average is at least partly offset by the statistical device of stratification of the sample. The relative probable error of the straight average was 0.312 per cent and the relative probable error of the weighted average, weighted by the wheat acreages in the crop-reporting districts, was 0.330 per cent.

CORN

Table 10 shows a comparison of the corn-price samples from several States for the 15th of the month, and December 1 prices (as reported by crop reporters) for Maryland, Iowa, and North Dakota.

TABLE 10.—*Farm prices of corn: Selected illustrations of size of sample, measures of dispersion, and probable error*

[Per bushel]

State and date	Number of reports	Average price (arithmetic mean)	Standard deviation of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error.[1]
Iowa:		*Cents*	*Cents*	*Per cent*	*Cents*	*Per cent*	*Per cent*
May, 1925	94	98.9	9.3	9.4	0.63	0.6	2.4
June, 1925	83	103.3	5.8	5.6	.43	.4	1.6
May, 1926	184	56.4	5.1	9.1	.26	.4	1.6
Georgia, November, 1926	55	99.3	18.7	18.8	1.70	1.7	6.8
Pennsylvania, November, 1926	43	80.7	14.5	18.0	1.49	1.9	7.6
Maryland:							
Mar. 15, 1926	38	70.9	7.9	11.0	.87	1.2	4.8
Dec. 1, 1925 [2]	115	74.4	16.4	22.0	1.03	1.3	5.2
Iowa, Dec. 1, 1925 [2]	341	56.9	5.9	10.4	.22	.4	1.6
North Dakota, Dec. 1, 1925 [2]	75	56.6	13.2	23.3	1.11	2.0	8.0

[1] The probabilities are ninety-nine out of one hundred that the average of a much larger sample collected in the same way and at the same time would not vary from this average by more than four times the probable error.

[2] The Dec. 1 prices were reported by crop reporters and not by the regular price reporters, who report on the 15th of each month.

Prices of corn in a surplus-producing State like Iowa, have only about half the variability of prices of corn in a deficit corn-producing State like Georgia or Pennsylvania. The Iowa farm price of corn for May, 1926, was 56.4 cents as compared with 103.3 cents in June, 1925, and the standard deviations of the prices received were 5.1 and 5.8 cents. With the much larger sample in May, 1926, 184 reports as compared with 83 in June, 1925, the relative probable errors of the averages were 0.26 cent and 0.43 cent. But with the average price in May, 1926, much smaller than in June, 1925, the relative probable error was the same for both averages (0.4 per cent).

Maryland was practically self-sufficing so far as the 1925 corn crop was concerned; in fact, corn was shipped from Maryland to both Virginia and Pennsylvania. The 15th-of-the-month price reflects this situation better than the December 1 price. The December 1 price had a coefficient of variability of 22 per cent when the few high prices from parts of the State where very little corn is raised were included, whereas the 15-of-the-month prices which were from sections of the State where some corn was being sold, showed only 11 per cent variability.

The relative probable errors of these samples indicate that the probabilities are ninety-nine out of one hundred that an indefinitely larger sample collected in the same way and at the same time would not vary more than about 2 per cent for Iowa, 7 or 8 per cent for Georgia and Pennsylvania, and 5 per cent for Maryland from the averages obtained from these samples. For a State of surplus production like Iowa, the sample is large enough, considering the small variability of the sample, to give a high degree of stability to the average. For Maryland the greater variability of the December 1 prices as compared with those for the 15th of the month is offset by the larger sample; and as a result, the relative probable error in both cases is about 1.3 per cent, and four times the probable error would be only 5 per cent even in this relatively small State where agricultural conditions vary greatly. Both Georgia and Pennsylvania are deficit States. The variability is fairly high and the number of reports not large, and as a result the average obtained is much less stable than in a surplus corn State. The December 1 prices for Iowa have less than half the variability of the prices in the North Dakota sample. North Dakota has both surplus and deficit areas of corn production and a wide range in the quality of corn produced. The variability of the corn prices in a surplus corn State such as Iowa is about the same as that of wheat prices in a surplus wheat State. Both Kansas and Iowa are large States from which a good-sized sample of prices can be obtained each month. Low variability and large samples result in average prices that are highly stable and reliable. Prices of wheat even in States that produce little wheat are dominated by the market prices prevailing in the central markets, and this fact tends to hold the variability of wheat prices lower than the variability of prices of corn which is largely fed on the farm where produced or sold to a neighbor.

OATS

Oats are sold in the organized markets of the country, but they are like corn in that much of the crop is fed in the neighborhood where it is grown, except in the large surplus-producing oat States of the Middle West. Table 11 shows that the coefficient of variability of oat prices is seldom below 10 per cent, even in the surplus-producing oat States of North Dakota, Illinois, and Indiana. Only in one of the Southern States does the variability rise much above 15 per cent. In North Dakota the coefficient of variability was reduced from 15.3 to 6.1 per cent by eliminating a few high prices which were probably for especially selected seed oats. Quotations of seed prices undoubtedly occur with greater frequency among oat prices than among wheat or corn prices. A large part of the wheat

crop is normally sold as grain, and sales of seed are only a very small part of the total sales; but with oats, the sales for seed are relatively more numerous, and hence appear more frequently in a price sample. In some localities the sales of seed oats may be the only sales.

TABLE 11.—*Farm prices of oats: Selected illustrations of size of sample, measures of dispersion, and probable error*

[Per bushel]

State and date	Number of reports	Average price (arithmetic mean)	Standard deviation of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error [1]
		Cents	*Cents*	*Per cent*	*Cents*	*Per cent*	*Per cent*
Indiana, June, 1925	81	49	5.7	11.6	0.4	0.9	3.6
Illinois, June, 1925	42	46	5.5	11.9	.6	1.2	4.8
Missouri, June, 1925	27	51	6.0	11.7	.8	1.5	6.0
New York, October, 1925	101	47	6.9	14.8	.5	.9	3.6
Pennsylvania, November, 1925	53	47	5.0	10.6	.5	1.0	4.0
Maryland, March, 1926	24	57	8.5	15.0	1.2	2.1	8.4
North Dakota, October, 1925 (price range, 20 to 40 cents)	59	26	4.0	15.3	.4	1.4	5.6
North Dakota, October, 1925 (price range, 20 to 29 cents)	53	25	1.5	6.1	.2	.7	2.8
Georgia, October, 1925	29	88	16.5	18.7	2.1	2.4	9.6
North Dakota, December, 1925 [2]	247	37	3.4	9.1	.1	.4	1.6
Maryland, December, 1925 [2]	66	49	7.0	14.3	.6	1.2	4.8

[1] The probabilities are ninety-nine out of one hundred that the average of a much larger sample collected in the same way and at the same time would not vary from this average by more than four times the probable error.

[2] The Dec. 1 prices were reported by crop reporters, and not by the regular price reporters, who report on the 15th of each month.

The larger size of the sample for the December 1 prices renders the averages for that date more stable than is the averages of the 15th-of-the-month prices. Four times the probable error is less than 5 or 6 per cent of the monthly price averages for the larger States, including New York, and Pennsylvania, which are not thought of as surplus oat States. For both Maryland and Georgia, the sample was not sufficiently large to hold the probable error down to a point where four times the relative probable error is less than 6 per cent, but even in those States, four times the relative probable error does not exceed 10 per cent. On the whole, oat prices are reasonably reliable.

COTTON AND COTTONSEED

In looking over cotton prices for the several Southern States (Table 12), one is impressed with the smallness of the coefficients of variability of the prices of cotton lint, which is sold on a highly organized local market, as compared with the variability of the prices of cottonseed, which the farmer considers a by-product. The number of reports on cotton prices is relatively small for most of the States, but the variability is sufficiently low to keep the probable error at a point where four times the probable error ranges from as low as 1.2 per cent to not more than 7 or 8 per cent. Cottonseed prices seem to share the great variability of most farm prices for Southern States other than those of cotton lint. As the season advanced from August, with few sales, to October, when the season is at its height, the number of reports received increased materially.

Cotton lint is the only important crop none of which is consumed on the farm or used for seed. The supply of American cotton is

the dominating factor in determining the world price of cotton, and it is not likely that one portion of the crop will be on an export-price basis while another is on an import-price basis, as is sometimes the case with wheat, barley, and tobacco. About the only disturbing factor, aside from quality, due to weather conditions, and aside from freight rates, is the differential between long-staple and short-staple prices. The greater intrinsic value of cotton lint per pound, as compared with that of wheat, corn, or hay, minimizes the effect of differences in freight rates upon the variability of the sample within a State. Cotton is such an important product in the Cotton Belt that the average reporter is usually well-informed concerning the prevailing price. The December 1 price for Texas is based on so many reports that the greater variability is more than offset, and four times the probable error is only 1.2 per cent of the average price. (See Table 8, p. 23 for the range and distribution by crop districts of the December 1 Texas cotton prices as reported by the crop reporters who report to Washington.) Cotton prices are fully as reliable as wheat, corn, oats, and flaxseed prices in surplus-producing States.

TABLE 12.—*Farm prices of cotton and cottonseed: Selected illustrations of size of sample, measures of dispersion, and probable error*

Commodity, date, and State	Number of reports	Average price (arithmetic mean)	Standard deviation of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error [1]
Cotton, per pound:							
August, 1925—		*Cents*	*Cents*	*Per cent*	*Cents*	*Per cent*	*Per cent*
North Carolina	11	23.5	1.5	6.6	0.32	1.4	5.6
South Carolina	27	23.8	1.6	6.7	.21	.9	3.6
Georgia	34	23.5	1.4	6.1	.17	.7	2.8
Tennessee	9	23.7	1.7	7.3	.38	1.6	6.4
Alabama	62	23.0	1.0	4.2	.08	.3	1.2
Mississippi	26	23.4	2.2	9.4	.30	1.3	5.2
Louisiana	7	22.7	.7	3.0	.18	.8	3.2
Texas	52	23.7	1.0	4.2	.09	.4	1.6
Oklahoma	8	24.1	1.8	7.6	.44	1.8	7.2
Arkansas	7	23.0	1.8	7.7	.46	2.0	8.0
September, 1926—							
North Carolina	18	22.1	1.1	4.9	.17	.8	3.2
South Carolina	35	21.8	.6	2.8	.08	.4	1.6
Georgia	48	22.0	.9	4.2	.09	.4	1.6
Tennessee	17	22.5	2.3	10.2	.38	1.7	6.8
Alabama	47	22.0	.9	4.0	.09	.4	1.6
Mississippi	34	22.2	2.2	9.7	.25	1.1	4.4
Louisiana	12	21.5	1.1	5.1	.21	1.0	4.0
Texas	74	22.4	1.5	6.5	.12	.5	2.0
Oklahoma	22	23.1	1.7	7.0	.24	1.0	4.0
Arkansas	28	23.2	1.2	5.3	.17	.7	2.8
October, 1925—							
North Carolina	23	21.0	1.1	5.1	.15	.7	2.8
South Carolina	40	20.9	1.0	4.8	.11	.5	2.0
Georgia	44	21.4	1.3	6.2	.13	.6	2.4
Alabama	67	20.7	1.1	5.3	.08	.4	1.6
Mississippi	55	21.6	1.5	6.9	.14	.6	2.4
Texas	109	21.6	1.7	8.0	.11	.5	2.0
Oklahoma	24	21.6	1.7	7.7	.23	1.1	4.4
Arkansas	31	20.7	1.8	8.6	.21	1.0	4.0
Dec. 1, 1925, [2] Texas	583	18.6	2.1	11.3	.06	.3	1.2
Cottonseed, per ton:							
November, 1925—		*Dollars*	*Dollars*		*Dollars*		
Mississippi	36	24.70	4.60	18.6	0.520	2.1	8.4
Louisiana	11	24.55	6.00	24.4	1.220	5.0	20.0
Oklahoma	11	25.20	3.25	12.9	.660	2.6	10.4
Texas	100	29.70	4.23	14.2	.285	1.0	4.0

[1] The probabilities are ninety-nine out of one hundred that the average of a much larger sample collected in the same way and at the same time would not vary from this average by more than four times the probable error.

[2] The Dec. 1 prices were reported by crop reporters and not by regular price reporters, who report on the 15th of each month.

BARLEY, RYE, FLAXSEED, BUCKWHEAT, AND COWPEAS

Table 13 shows barley, rye, flaxseed, buckwheat, and cowpea price samples. Barley prices tend to be more variable than rye or flaxseed prices. There is a wide range in the quality of barley. The malting types of barley usually command higher prices than feed barley. This is another case, under certain conditions, of two modes in one sample. The difference between long and short haul freight charges is one cause of price variation, especially in a large State like California where the outlet is largely in one direction.

TABLE 13.—*Farm prices of barley, rye, flaxseed, buckwheat, and cowpeas: Selected illustrations of size of sample, measures of dispersion, and probable yield*

[Per bushel]

Commodity, date, and State	Number of reports	Average price (arithmetic mean)	Standard deviation of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error [1]
Barley:							
October, 1925—		*Cents*	*Cents*	*Per cent*	*Cents*	*Per cent*	*Per cent*
Minnesota	100	51.6	7.4	14.3	0.5	1.0	4.0
California	16	77.5	11.0	14.2	1.9	2.5	10.0
November, 1925, California	9	85.0	13.9	16.4	3.1	3.7	14.8
March, 1926, Maryland	7	87.9	8.2	9.2	2.1	2.4	9.6
December, 1925,[2] Maryland	20	84.8	15.2	17.9	2.3	2.7	10.8
Rye:							
June, 1925, Minnesota	68	102.3	10.4	10.2	.9	.8	3.2
March, 1926, Maryland	9	91.1	12.9	14.1	2.9	3.2	12.8
December, 1925,[2] Maryland	54	108.9	21.2	19.5	2.0	1.8	7.2
Flaxseed:							
June, 1925, North Dakota	51	247.0	11.1	4.5	.8	.3	1.2
Buckwheat:							
March, 1926, Maryland	5	95.0	2.0	2.1	.6	.6	2.4
Dec. 1, 1925,[2] Maryland	29	101.9	17.4	17.0	2.2	2.2	8.8
Cowpeas:							
November, 1925, Alabama	28	251.0	62.0	24.7	7.9	3.1	12.4

[1] The probabilities are ninety-nine out of one hundred that the average of a much larger sample collected in the same way and at the same time would not vary from this average by more than four times the probable error.

[2] The Dec. 1 prices are reported by crop reporters and not by the regular price reporters, who report on the 15th of each month.

Flaxseed is a crop similar to wheat and cotton in that a large proportion of it is sold. North Dakota is a State of heavy flaxseed production; the producing area is well defined, and the local market is well organized to handle the crop. The range in price owing to quality is not large, and differences in freight rates are not great. As a result the medium-sized sample of 51 reports is sufficient to give a high degree of stability to the average—four times the relative probable error being only 1.2 per cent, one of the smallest percentages noted in this analysis.

It is difficult to obtain many reports on the price of buckwheat from the 15th-of-the-month reports. It is not until a large group of crop reporters are asked the question, as on December 1, that a sample of any size can be obtained in a State so small as Maryland. Buckwheat is grown commercially in rather limited areas, but small fields of it are grown here and there as a catch crop that never enters the channels of trade. Reporters are not well informed on the subject, and with a crop of such minor importance the variability of the sample tends to be rather large. The chief value of price series for

such minor crops as buckwheat and cowpeas is that they indicate the price trend over a period of a year or more. Since cowpeas are sold primarily for seed purposes and are grown in Southern States, it is not surprising to find a coefficient of variability of about 25 per cent as there are comparatively few reports and 12.4 per cent as four times the relative probable error. The farm prices of other seed crops such as soy beans, clover, timothy, and alfalfa seed are usually highly variable and the average prices relatively unstable because of the limited number of reports received on such minor crops.

HAY

Hay prices have large coefficients of variability in all sections of the country, whether the price is that of loose hay or baled hay, or whether it applies to timothy, clover, alfalfa, or prairie hay. Table 14 shows that the variability in prices is seldom less than 15 per cent, and that not often is it more than 25 per cent. With the size sample usually obtained in most States of fair size, the probable error is such that four times the relative probable error is from about 5 to 10 per cent. For some of the less important varieties of hay in a given State, the sample is so small that the probable error is much larger. Hay prices fluctuate considerably from month to month, but are valuable as indicating the trend of prices over a period of several months. The price of baled hay has been asked as a check question in order that the prices of loose hay might be reported as those of loose hay and not as those of baled hay, in some cases. The variability of baled-hay prices is apparently less than that of loose-hay prices.

TABLE 14.—*Farm prices of hay: Selected illustrations of size of sample, measures of dispersion, and probable error*

[Per ton]

State, commodity, and date	Number of reports	Average price (arithmetic mean)	Standard deviation of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error [1]
New York:							
Loose—		*Dollars*	*Dollars*	*Per cent*	*Dollars*	*Per cent*	*Per cent*
November, 1925	72	13.56	2.97	21.9	0.235	1.8	7.2
December, 1925	115	13.95	3.34	23.9	.210	1.5	6.0
Baled, December, 1925	91	16.44	2.35	14.3	.166	1.0	4.0
Timothy—							
December, 1925	75	15.68	3.45	22.0	.269	1.7	6.8
November, 1925	56	14.95	3.81	25.5	.342	2.3	9.2
Clover—							
December, 1925	59	13.24	2.80	21.1	.245	1.9	7.6
November, 1925	43	12.86	2.23	17.3	.229	1.8	7.2
Alfalfa, December, 1925	45	18.18	3.37	18.5	.339	1.9	7.6
Pennsylvania:							
Loose, December, 1925	28	16.25	3.80	23.4	.484	2.9	11.6
Baled, December, 1925	40	19.35	3.38	17.5	.362	1.9	7.6
Timothy, December, 1925	26	17.81	3.39	19.0	.449	2.5	10.0
Clover, December, 1925	27	16.30	3.39	20.8	.440	2.7	10.8
Alfalfa, December, 1925	7	20.14	3.44	17.1	.875	4.4	17.6
Maryland:							
Loose—							
March, 1926	21	18.43	3.50	19.0	.515	2.8	11.2
December, 1925	93	18.94	3.78	20.0	.266	1.4	5.6

[1] The probabilities are ninety-nine out of one hundred that the average of a much larger sample collected in the same way and at the same time would not vary from this average by more than four times the probable error.

TABLE 14.—*Farm prices of hay: Selected illustrations of size of sample, measures of dispersion, and probable error*—Continued

State, commodity, and date	Number of reports	Average price (arithmetic mean)	Standard deviation of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error
Maryland—Continued.		*Dollars*	*Dollars*	*Per cent*	*Dollars*	*Per cent*	*Per cent*
Baled, March, 1926	23	22.42	3.06	13.7	0.431	1.9	7.6
Timothy, March, 1926	15	21.60	3.03	14.0	.528	2.4	9.6
Clover, March, 1926	14	18.29	3.41	18.6	.615	3.4	13.6
Alfalfa, March, 1926	11	24.18	4.63	19.1	.942	3.9	15.6
Nebraska:							
Loose, December, 1925	69	10.93	2.57	23.5	.209	1.9	7.6
Baled, December, 1925	60	13.35	2.74	20.5	.238	1.8	7.2
Clover, December, 1925	10	14.00	2.97	21.2	.634	4.5	18.0
Alfalfa, December, 1925	89	13.74	2.88	21.0	.206	1.5	6.0
Prairie, December, 1925	59	10.78	2.57	23.8	.226	2.1	8.4
Iowa:							
Loose, December, 1925	99	12.90	2.79	21.6	.189	1.5	6.0
Baled, December, 1925	67	15.42	2.90	18.8	.239	1.6	6.4
Timothy, December, 1925	71	13.48	2.76	20.5	.222	1.6	6.4
Clover, December, 1925	73	14.00	2.81	20.1	.222	1.6	6.4
Alfalfa, December, 1925	58	15.29	3.36	22.0	.298	2.0	8.0
Prairie, December, 1925	27	11.11	3.35	30.2	.435	3.9	15.6
Wisconsin:							
Loose, December, 1925	37	13.54	2.19	16.2	.242	1.8	7.2
Baled, December, 1925	42	15.05	2.48	16.5	.258	1.7	6.8
Timothy, December, 1925	35	15.40	2.96	19.2	.337	2.2	8.8
Clover, December, 1925	30	15.37	3.55	23.1	.435	2.9	11.6
Alfalfa, December, 1925	17	19.18	2.62	13.7	.429	2.2	8.8
Prairie, December, 1925	11	10.09	2.74	27.2	.557	5.6	22.4
Indiana:							
Loose, June, 1925	42	12.48	3.55	28.4	.370	2.9	11.6
Georgia:							
Loose, November, 1925	16	19.81	4.65	23.5	.792	4.0	16.0

The range in quality of hay is large even in a given locality. The differences in freight rates within a State accentuate the variability of the prices reported. Nearness to a large city tends to cause higher hay prices than prevail further from cities. Hay belongs to that class of farm products in which a wide range in prices may be expected. A good way to visualize a series of prices made up from small samples with considerable variability is to think of them as a belt or band extending over a period of a year or more. The average price may shift about somewhat from month to month because of the fluctuations in the respective samples, but the general trend of the price movement is indicated as the general belt or band moves along.

POTATOES

The price of potatoes has about twice the variability of the price of wheat and cotton. Handling and hauling charges, including freight rates, cause a considerable difference between the price of potatoes in deficit and surplus-producing areas in the same State. During the years from about 1915 to 1923 the development of quotations for potatoes on the hundredweight basis led reporters to record 100-pound prices erroneously when bushel prices were requested. It was not always possible to edit out or convert such reports. Beginning with January, 1925, the price of potatoes has been asked on both a bushel and hundredweight basis; this has improved the accuracy of potato prices in those States where part or all are sold on a 100-pound basis.

Table 15 shows the prices for potatoes and sweet potatoes in a few States. In New York State the large number of reports on the price of potatoes by months was sufficient to hold the probable error down to a point where four times the relative probable error was only 3.2 per cent. The December 1 sample was so much larger than the monthly price sample that four times the probable error was only 2.4 per cent. While the price of sweet potatoes for New Jersey and for Maryland has about the same variability as that of potatoes—15 to 20 per cent—the Georgia price sample showed over 30 per cent variation. The prices for sweet potatoes are much less satisfactory than the prices for other potatoes, largely because of the small number of reports received and the wide dispersion of the prices. In many parts of the South sweet potatoes are not raised on a commercial scale, and the price is dependent on the local supply and demand.

TABLE 15.—*Farm prices of potatoes: Selected illustrations of size of sample, measures of dispersion, and probable errors*

Product, unit of measure, State, and date	Number of reports	Average price (arithmetic mean)	Standard deviation of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error [1]
Potatoes:							
Per bushel—							
New York, November, 1925	185	*Cents* 210	*Cents* 34.7	*Per cent* 16.5	*Cents* 1.7	*Per cent* 0.8	*Per cent* 3.2
Maine, November, 1925	74	219	35.9	16.4	2.9	1.4	5.6
Maryland, March, 1926	32	263	50.7	19.3	6.0	2.3	9.2
Per 100 pounds—							
Idaho, November, 1925	32	240	43.8	18.2	5.2	2.2	8.8
Per bushel—							
Maryland, Dec. 1, 1925 [2]	105	193	40.8	21.2	2.7	1.4	5.6
Per 100 pounds—							
Maryland, Dec. 1, 1925 [2]	34	364	71.8	19.7	8.3	2.3	9.2
Per bushel—							
New York, Dec. 1, 1925 [2]	569	219	43.7	20.0	1.2	.6	2.4
Sweet potatoes:							
Per bushel—							
Georgia, November, 1925	55	149	47.4	31.9	4.3	2.9	11.6
New Jersey, November, 1925	12	238	36.0	15.1	7.0	3.0	12.0
Maryland, March, 1926	11	217	37.5	17.3	7.6	3.5	14.0
Maryland, Dec. 1, 1926 [2]	33	181	42.5	23.5	5.0	2.8	11.2

[1] The probabilities are ninety-nine out of one hundred that the average of a much larger sample collected in the same way and at the same time would not vary from this average by more than four times the probable error.

[2] The Dec. 1 prices were reported by crop reporters and not by the regular price reporters, who report on the 15th of each month.

APPLES

Apple prices are about as unsatisfactory as any of the major price series which the department collects. The dispersion in the price reports received is so wide that ordinarily not enough reports are received to give stability to the average price. Table 16 shows that it is not at all unusual for an apple-price sample to have a coefficient of variability of from 30 to 40 per cent. It is only in the larger apple States, where the sample is much larger than the usual State sample, that a degree of stability is reached which holds the probable error to a point where four times the relative probable error is less than 10 per cent of the average price.

TABLE 16.—*Farm prices of apples: Selected illustrations of size of sample, measures of dispersion, and probable error*

Unit of measure, State, and date	Number of reports	Average price (arithmetic mean)	Standard deviation of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error [1]
Per bushel:		*Cents*	*Cents*	*Per cent*	*Cents*	*Per cent*	*Per cent*
New York, October, 1925	150	102.9	37.5	36.4	2.1	2.0	8.0
Michigan, October, 1925	73	87.1	32.0	36.7	2.5	2.9	11.6
Virginia, October, 1925	61	94.3	38.0	40.2	3.3	3.5	14.0
West Virginia, October, 1925—							
Regular	30	138.9	41.3	29.7	5.1	3.7	14.8
Commercial	14	81.4	36.4	44.6	6.6	8.1	32.4
Regular and commercial	44	120.4	47.7	39.6	4.8	4.0	16.0
Maryland—							
October, 1925	22	91.8	37.0	40.3	5.3	5.8	23.2
March, 1926	17	136.8	52.7	38.5	8.6	6.3	25.2
Dec. 1, 1925 [2]	74	118.1	43.0	36.4	3.4	2.9	11.6
Per barrel:							
New York, October, 1925	110	343.0	80.1	23.4	5.1	1.5	6.0
Michigan, October, 1925	37	278.5	91.8	32.9	10.2	3.7	14.8
Virginia, October, 1925	72	321.9	82.0	25.5	6.5	2.0	8.0
West Virginia, October, 1925—							
Regular	12	383.2	125.2	32.7	24.4	6.4	25.6
Commercial	30	316.8	44.5	14.0	5.5	1.7	6.8
Regular and commercial	42	339.1	89.8	26.5	9.0	2.7	10.8
Maryland—							
October, 1925	9	302.8	90.0	29.7	20.2	6.7	26.8
Dec. 1, 1925 [2]	39	372.4	93.2	25.0	10.1	2.7	10.8

[1] The probabilities are ninety-nine out of one hundred that the average of a much larger sample collected in the same way and at the same time would not vary from this average by more than four times the probable error.

[2] The Dec. 1 prices were reported by crop reporters and not by the regular price reporters, who report on the 15th of each month.

With a range in price per bushel of from 30 to 250 cents, as was the case with the West Virginia, October, 1925, prices, a coefficient of variability of 40 per cent is not surprising. Cull, unsprayed, cider, and evaporator apples always sell for much lower prices than well-sprayed, high-grade apples of some of the choicer varieties.

An effort has been made to obtain apple prices within the commercially important counties, but even for these counties the reported prices per bushel have showed fully as much variability as elsewhere in the State. The prices per barrel in those counties, however, showed a variability of only 14 per cent, as compared with a variability of about 33 per cent for the entire State of West Virginia. In commercial sections a barrel of apples represents a more or less standardized product, whereas a bushel of apples sold includes varying proportions of culls.

Apple prices illustrate the difficulties involved in attempting to arrive at a single price series for a given product which will answer the various purposes for which a price series is ordinarily used. Even in a single locality there are on the one hand individual farmers who take excellent care of their orchards, who handle, grade, and pack their fruit with great care and dispose of it by means of auto truck in some city market at a fancy price. At the other extreme are farmers who use their orchards for hog pasture, spray only once or twice, if at all, and sell the fruit on the tree to the local buyer. The practice of most growers lies between these two extremes. In addition to variations in price caused by such extremes in farm

practice, there are wide price differentials owing to the fact that different varieties are being sold within a limited area. Sales within an area may include such varieties as Ben Davis, Baldwin, Wealthy, and Delicious.

A price series by varieties would be misleading in years of light production or heavy production of those particular varieties. The barrel price is not always satisfactory because over a period of years the cost of the barrel in which the apples are packed is not the same and in some years its cost exceeds the value of the apples packed in it. The reported price series for any farm product which is sold in containers is affected by variations in the value of the container.

ANALYSIS OF PRICES OF LIVESTOCK AND LIVESTOCK PRODUCTS

HOGS

Hogs from the North Central States are sold on a highly organized market. The local market for hogs in these States is fully as sensitive to price changes in the primary markets as are the local markets for wheat and cotton. Table 17 shows that the coefficient of variability of prices of hogs per 100 pounds in a surplus-producing State like Iowa is as low as that of wheat in Kansas or cotton in the South. Because of the low variability of the sample, the number of reports received on the price of hogs in Iowa is sufficient to hold the probable error to a point where four times the relative probable error is frequently less than 2 per cent.

The fact that the local hog markets of Maryland are in close touch with the Baltimore market tends to hold the variability at the low figure, 6.1 per cent, for March, 1926. In Virginia local-market demand is an important factor in hog prices, and as a result the coefficient of variability, about 16 per cent, is higher than that in either Iowa or Maryland.

Hog prices in States of surplus production are fully as reliable as wheat, cotton, or flax prices and are probably more dependable than any other livestock or livestock-product prices.

TABLE 17.—*Farm prices of hogs: Selected illustrations of size of sample, measures of dispersion, and probable errors*

[Per 100 pounds live weight or per head]

State and date	Number of reports	Average price (arithmetic mean)	Standard deviation of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error [1]
Iowa:		*Dollars*	*Dollars*	*Per cent*	*Dollars*	*Per cent*	*Per cent*
October, 1924	45	10.21	0.90	8.8	0.09	0.9	3.6
March, 1925	92	12.63	.95	7.5	.07	.6	2.4
April, 1925	61	12.28	.53	4.3	.05	.4	1.6
May, 1925	91	11.22	.83	7.2	.06	.5	2.0
June, 1925	85	11.17	.50	4.5	.04	.3	1.2
Jan. 1, 1926 [2]	278	17.06	4.65	27.2	.19	1.1	4.4
Virginia:							
October, 1924	28	9.51	1.50	15.7	.19	2.0	8.0
April, 1925	90	11.48	1.84	16.0	.13	1.2	4.8
Maryland:							
March, 1926	24	13.25	.80	6.1	.11	.8	3.2

[1] The probabilities are ninety-nine out of one hundred that the average of a much larger sample collected in the same way and at the same time would not vary from this average by more than four times the probable error.

[2] These are Jan. 1 value of hogs per head, as reported by crop reporters, who are farmers. The January, 1926, report summarizes about half the schedules received; the other half of the schedules reported hog values by subclasses.

The January 1 value of all hogs per head in Iowa has a variability of 27 per cent. Such high variability is to be expected when the value of fall pigs and the value of breeding stock are included in the same estimate. There are many more fall pigs in the southern half of Iowa than in the northern part; in several of the northern counties almost the only hogs that would be on farms on January 1 would be either hogs about ready for market or breeding stock. For the entire period of record the January 1 value of hogs per head has been obtained from a question asking for the average price of swine of all ages. In January, 1926, the value of hogs was obtained from about half of the list of crop reporters on the basis of all hogs, as shown in Table 17; from the other half of the list on the basis of three subclasses; namely, (1) pigs under 6 months, (2) sows and gilts bred or to be bred for spring pigs, and (3) all other hogs 6 months old and over, including boars. The average price of all hogs was higher when determined on the basis of the three subclasses.

BEEF CATTLE AND VEAL CALVES

Prices of beef cattle per 100 pounds liveweight are highly variable; the coefficients of variability as shown in Table 18 for several beef-cattle price samples are all above 20 per cent. There is a wide range in the quality of cattle in a single State. Even in Iowa the price in some localities would apply to a poor grade of feeder cattle or cows, whereas that in another would apply to well-finished fat cattle. In dairy regions the cattle sold for beef are mostly worn-out dairy cows or old bulls. The variability seems to run consistently above 20 per cent whether the sample be taken in Maryland, Iowa, or the range States. Only in the States where a large price sample can be obtained is it possible to have enough reports to hold the probable error down to a point where four times the relative probable error is less than 10 per cent.

TABLE 18.—*Farm prices of beef cattle and veal calves: Selected illustrations of size of sample, measures of dispersion, and probable errors*

[Per 100 pounds live weight]

Product, State, and date	Number of reports	Average price (arithmetic mean)	Standard deviation of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error [1]
Beef cattle:		*Dollars*	*Dollars*	*Per cent*	*Dollars*	*Per cent*	*Per cent*
Iowa, October, 1925	116	9.36	2.06	22.1	0.13	1.4	5.6
Colorado, October, 1925	23	6.32	1.58	25.0	.22	3.5	14.0
Wyoming, October, 1925	10	5.82	1.22	20.9	.26	4.5	18.0
Maryland, March, 1926	16	7.62	1.66	21.8	.28	3.7	14.8
Veal calves:							
New York, July, 1925	94	10.62	1.34	12.6	.09	.9	3.6
Wisconsin, July, 1925	71	9.08	1.40	15.4	.11	1.2	4.8
Alabama, July, 1925	40	5.64	1.86	32.9	.20	3.5	14.0
California, July, 1925	28	9.41	2.06	21.8	.27	2.9	11.6
Maryland, March, 1926	22	12.57	1.27	10.2	.18	1.5	6.0

[1] The probabilities are ninety-nine out of one hundred that the average of a much larger sample collected in the same way and at the same time would not vary from this average by more than four times the probable error.

The farm price of veal calves is less variable than that of beef cattle in the Northern States, but is very highly variable in Alabama, where practically all farm prices except cotton are highly variable. Table 18 shows that the number of reports received from both New York and Wisconsin was sufficient to keep the probable error at a point where four times the relative probable error was less than 4 per cent. The farm price of veal calves is more reliable than the farm price of beef cattle, and it is nearly as dependable as that of hogs.

HORSES AND MILK COWS

The farm prices of dairy cattle and of horses per head are more variable than the prices of beef cattle or veal calves per 100 pounds live weight. The price of hogs per head was much more variable than the price per 100 pounds live weight. The value per head includes not only the variability in value per pound due to finish, condition, quality, and age, but also the differences caused by size and weight. The variability in milk-cow prices, as shown in Table 19, was about the same in Georgia, a southern State, as in New York and Wisconsin, two dairy States. The variability of the June, 1925, sample for Wisconsin, as reported by the regular price reporters, was about the same as the variability of the January 1, 1926, sample as reported by the crop reporters, but the larger sample in January reduced probable error to a point where four times the relative probable error is less than 5 per cent for both milk cows and horses. In the larger States, where the sample is of fair size, the probable error is such that the four times the relative probable error is seldom above 10 per cent.

TABLE 19.—*Farm prices of horses and milk cows: Selected illustrations of size of sample, measures of dispersion, and probable errors*

Class of livestock, State, and date	Number of reports	Average price (arithmetic mean)	Standard deviations of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error [1]
Milk cows, per head:		*Dollars*	*Dollars*	*Per cent*	*Dollars*	*Per cent*	*Per cent*
New York, November, 1925	105	82.21	20.35	24.8	1.38	1.7	6.8
Wisconsin—							
June, 1925	68	66.74	17.38	26.0	1.42	2.1	8.4
Jan. 1, 1926 [2]	273	66.78	17.23	25.8	.70	1.1	4.4
Georgia, November, 1925	52	34.62	8.00	23.1	.75	2.2	8.8
Maryland, March, 1926	26	74.60	24.95	33.5	3.31	4.4	17.6
Horses, per head:							
Indiana—							
June, 1925	74	82.62	24.50	29.7	1.92	2.3	9.2
Jan. 1, 1926 [3]	478	78.06	28.20	36.1	.87	1.1	4.4
Maryland, March, 1926	25	101.40	31.90	31.5	4.30	4.2	16.8

[1] The probabilities are ninety-nine out of one hundred that the average of a much larger sample collected in the same way and at the same time would not vary from this average by more than four times the probable error.

[2] Jan. 1 value of milk cows per head as reported by crop reporters, from about half the regular list, on Jan. 1, 1926.

[3] Jan. 1 value of horses over 2 years of age, per head, as reported by crop reporters.

SHEEP, LAMBS, AND WOOL

Table 20 shows a comparison of sheep, lamb, and wool prices. The variability in prices of sheep seems to be slightly greater on a per head basis than on a per 100-pound basis. The variability of lamb prices per head was two or three times as large as that of prices of lamb per 100 pounds. Wool prices are less variable than sheep prices or lamb prices on a per head basis. Wool and lamb prices with a variability of about 10 per cent are reasonably satisfactory in the larger States where the price samples are fairly large. The number of reports received from the far Western States such as Colorado and Wyoming are not sufficient to hold the probable error down to a point where four times the relative probable error is much less than 10 per cent.

TABLE 20.—*Farm prices of sheep, lambs, and wool: Selected illustrations of size of sample, measures of dispersion, and probable errors*

Livestock or livestock products, State, and date	Number of reports	Average price (arithmetic mean)	Standard deviation of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error [1]
Sheep (per 100 pounds live weight):		*Dollars*	*Dollars*	*Per cent*	*Dollars*	*Per cent*	*Per cent*
Ohio, October, 1925	63	6.40	1.76	27.5	0.15	2.3	9.2
Colorado, October, 1925	12	7.67	1.83	23.9	.36	4.6	18.4
Ewes (per head):							
Ohio, January, 1926 [2]	383	10.19	2.96	29.0	.10	1.0	4.0
Colorado, Jan. 1, 1926 [2]	69	10.69	2.82	26.4	.23	2.1	8.4
Lambs (per 100 pounds live weight):							
Ohio—							
October, 1925	66	12.50	1.36	10.9	.11	.9	3.6
Jan. 1, 1926 [2]	357	9.28	3.12	33.6	.11	1.2	4.8
Colorado—							
October, 1925	15	12.97	1.17	9.0	.20	1.6	6.4
Jan. 1, 1926 [2]	72	9.94	2.48	24.9	.20	2.0	8.0
Wool (per pound):		*Cents*	*Cents*		*Cents*		
Wisconsin, June, 1925	44	36.5	3.0	8.2	.30	.8	3.2
Ohio, July 1925	88	43.6	6.4	14.6	.46	1.1	4.4
Wyoming, July, 1925	10	34.0	4.7	13.8	1.01	3.0	12.0

[1] The probabilities are ninety-nine out of one hundred that the average of a much larger sample collected in the same way and at the same time would not vary from this average by more than four times the probable error.

[2] Jan. 1, livestock values per head are reported by crop reporters.

BUTTER AND BUTTERFAT

A comparison of butter and butterfat price samples is shown in Table 21. In the Northern States there seems to be little difference in the variability of the price samples of butter and of butterfat. In Alabama, for the month of April, butter prices had over three times the variability of butterfat prices. The production of butterfat is limited almost entirely to areas near large towns and cities. The wide range in butter prices in the Southern States is undoubtedly due to a wide range in the quality of country butter. In the Northern States a much larger proportion of the butter is made in creameries or at least under better conditions than are likely to prevail in a much warmer climate. The variability of butter and butterfat

prices in Northern States is really very small as compared with the variability of prices of livestock. In the more important butter States the sample is sufficiently large to make the probable error so small that four times the relative probable error is only about 2.5 per cent, nearly as low as for wheat, cotton, and hog prices in important producing States.

TABLE 21.—*Farm prices of butter and butterfat: Selected illustrations of size of sample, measures of dispersion, and probable errors*

[Per pound]

Product, State, and date	Number of reports	Average price (arithmetic mean)	Standard deviation of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error [1]
		Cents	*Cents*	*Per cent*	*Cents*	*Per cent*	*Per cent*
Minnesota, April, 1925:							
Butter	126	42.1	3.9	9.2	0.23	0.5	2.0
Butterfat	111	42.8	3.9	9.1	.25	.6	2.4
Alabama, April, 1925:							
Butter	80	34.2	8.6	25.1	.65	1.9	7.6
Butterfat	15	41.6	3.1	7.5	.56	1.3	5.2
Wisconsin, June, 1925:							
Butter	80	42.9	3.4	7.9	.26	.6	2.4
Butterfat	40	44.5	3.7	8.4	.40	.9	3.6
California, April, 1925:							
Butter	12	44.6	4.9	11.1	.96	2.2	8.8
Butterfat	17	44.5	4.9	11.0	.80	1.8	7.2
Maryland, March, 1926:							
Butter	34	45.9	7.6	16.6	.90	1.9	7.6

[1] The probabilities are ninety-nine out of one hundred that the average of a much larger sample collected in the same way and at the same time would not vary from this average by more than four times the probable error.

The price of butterfat has been obtained only since October, 1920. For the United States as a whole the prices of butter and butterfat are usually about the same in the summer months, but butterfat prices are somewhat higher during the winter months than butter prices. Farm prices of butter during the postwar years show a greater increase over prices during pre-war years than do the primary-market price of 92-score butter. The quantity of country-made butter has steadily decreased during the period, as creamery butter has increased, and the quality has materially improved. A much larger proportion of farm butter is sold at the retail price level than was the case 10 or 15 years ago.

EGGS AND CHICKENS

There is probably no one farm product that is more generally sold throughout the country than eggs. Usually more reports are received on egg prices than on almost any other farm product. Table 22 describes the egg-price samples from a number of States in different parts of the country. Because of the wide seasonal differences in the prices of eggs, prices in a summer month and those in a winter month in several of the States are shown for comparison.

TABLE 22.—*Farm prices of eggs and chickens: Selected illustrations of size of sample, measures of dispersion, and probable errors*

Product, State, and date	Number of reports	Average price (arithmetic mean)	Standard deviation of reports	Coefficient of variability	Probable error of the average price or mean	Relative probable error	Four times relative probable error [1]
Eggs (per dozen):							
New York—		*Cents*	*Cents*	*Per cent*	*Cents*	*Per cent*	*Per cent*
July, 1925	167	35.6	4.7	13.1	0.24	0.7	2.8
December, 1925	201	61.0	7.9	13.0	.38	.6	2.4
Kansas—							
July, 1925	153	24.2	1.9	7.9	.11	.5	2.0
December, 1925	164	39.1	4.5	11.5	.24	.6	2.4
Nebraska—							
May, 1925	118	22.8	1.5	6.7	.09	.4	1.6
July, 1925	147	24.6	2.1	8.5	.12	.5	2.0
December, 1925	198	39.0	5.2	13.3	.25	.6	2.4
Missouri—							
July, 1925	93	25.2	1.8	7.1	.13	.5	2.0
December, 1925	79	41.4	4.9	11.8	.38	.9	3.6
Mississippi—							
July, 1925	52	22.7	3.4	15.1	.32	1.4	5.6
December, 1925	61	45.7	6.3	13.7	.54	1.2	4.8
Montana—							
July, 1925	48	27.8	4.4	15.8	.43	1.5	6.0
December, 1925	55	50.8	6.6	13.1	.61	1.2	4.8
Connecticut—							
July, 1925	27	44.1	5.2	11.7	.68	1.5	6.0
December, 1925	32	71.1	8.3	11.6	.99	1.4	5.6
Georgia—November, 1925	74	43.2	6.2	14.4	.49	1.1	4.4
Maryland—March, 1926	42	27.1	3.4	12.4	.35	1.3	5.2
Chickens (per pound):							
Georgia—November, 1925	66	24.0	4.3	17.9	.36	1.5	6.0
Maryland—March, 1926	38	28.3	3.8	13.5	.40	1.5	6.0

[1] The probabilities are ninety-nine out of one hundred that the average of a much larger sample collected in the same way and at the same time would not vary from this average by more than four times the probable error.

The variability of egg prices is as low as 6 to 8 per cent in the Corn Belt during the months of heavy summer production, but it is nearly double that in these same States in December. In New York and Connecticut, where the production of winter eggs is relatively more important than in the Central States, the variability is about the same in July as in December. It is possible that the premium on high-quality near-by eggs in the East, especially near the larger cities, tends to increase the variability of the sample. The variations in the Mississippi and Georgia samples are much lower relatively than the variation in the price samples of most other Southern products. Wide local differences existing in Western States such as Montana cause a wide dispersion in the egg prices received.

Because of the relatively low variability of egg prices and the large number of reports received the probable error is not usually very large, and four times the relative probable error in many States is less than 2 per cent; and even in such small States as Connecticut and Maryland four times the relative probable error does not exceed 6 per cent. The farm price of eggs lends itself to this method of collecting price data.

The two samples of chicken prices analyzed in Table 22 show about the same conditions as do egg prices, except that in the spring when "young fries" are bringing a premium, the range in price per pound is extremely wide and the variability of the sample is greater at that season of the year than at other times.

SUMMARY

Farm prices of cotton, wheat, and flax have small coefficients of variability in most States. Prices of corn, oats, hogs, veal calves, lambs, butter, butterfat, and eggs also show small variability in surplus-producing States. In most States the number of reports received as to the prices of these products is sufficient to render the monthly State price averages reasonably stable and reliable.[8]

Speaking in terms of probability, the chances are ninety-nine out one hundred or there is practical certainty that the average of a much larger sample taken at the same time and in the same way would fall within a range of from 1 to 5 per cent of the average obtained by the present sample.

With the prices of the remaining farm products it is only in those States where an unusually large number of reports are received that the size of the sample is sufficient to offset the higher variability and reduce the probable error to a point where four times the relative probable error is much below 10 per cent of the average price. Apples are about the only farm product where the variability in the prices of which is so high that four times the relative probable error is likely to exceed 20 per cent.

Generally speaking, the December 1 prices of crops and the January 1 values of livestock are based on so many more reports than the State monthly average prices, especially those of minor farm products, that they are much more reliable than are the monthly prices. It is not unusual, however, for a December 1 price or January 1 value sample to show a greater degree of variability than a corresponding monthly price. An additional safe guard at the present time is the fact that the December 1 price and the January 1 values are also obtained from another list of crop reporters who report to the State statistician. The results from both samples are combined to obtain the final figure.

A COMPARISON OF STATE FARM PRICES

The preceding analysis has been based entirely on the sample of price reports received for a given month by States. If the prices as reported each month for the major farm products in the larger States are reasonably stable and dependable from month to month, how do the price series in two different States compare over a period of several months or years? Do the prices in both States tend to move together each month or do they move in opposite directions at times? If they tend to move together, confidence in the reliability of the price series is increased.

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[8] These monthly prices are subject to defects in representativeness and to errors in computation, especially when the work on monthly prices is pushed rapidly each month in order to make the 15th-of-the-month prices available at the earliest possible moment. In months when the crop reports do not interfere the price report has been completed by the 25th or 27th of the month. As the price series for individual States are used in research problems, prices for a given month may appear to be inconsistent with the series. The Bureau of Agricultural Economics will appreciate being told of these inaccuracies, that eventually a revised edition of these prices may be published containing all necessary corrections. Farm prices should not be used as a basis for measuring the spread between farm prices and market prices, except where the State represents definitely a surplus-producing, commercialized area of production, as the prices from both deficient and surplus-producing areas are contained in an average farm price for a particular State.

Table 23 shows correlation studies of this kind with wheat, cotton, and potato prices. The entire period from the time monthly prices were started (1908 or 1909) through 1925 was divided into three periods: (1) the pre-war period (1908–1914)—a period during which the change in the general price level was not an important factor influencing the relationship between the two price series; (2) the war period, through deflation (1915–1921)—a period during which changes in price level, first upward and then downward, would tend to increase the correlation; (3) the postwar period (1922–1925)—a period during which changes in price level would have much less effect than during the second period, but perhaps more than during the first or pre-war period. Figures for the entire period are also given for the sake of comparison.

WHEAT

One would expect wheat prices in New York, Pennsylvania, and Maryland to run along together rather closely over a period of several months. The correlation coefficient is a useful measure of the relationship existing between such price series as these (*11, p. 157–228*). The plus correlation between Maryland and Pennsylvania wheat prices is unusually high, considering the small size of the Maryland sample. Maryland is a small State, and the number of reports received would naturally be fewer than from some of the larger States, and yet the movement of farm prices of wheat is very close to the movement of prices of wheat in the neighboring State of Pennsylvania.

In fact, the correlation between the farm prices of wheat in Maryland and in Pennsylvania is practically the same as that between wheat prices in Pennsylvania and in New York, period by period. These correlation coefficients range from plus 0.974 to 0.994. They are slightly higher during the war period, when great differences in price level were a contributing factor to the relationship. The correlation between farm prices of wheat in Illinois and in Indiana is slightly higher than that between either Maryland and Pennsylvania or Pennsylvania and New York. Figures 5 and 6 show the general trend and the close correlation between monthly wheat prices in these States for the entire period.

TABLE 23.—*Farm prices: Correlation between the farm-price series of wheat, cotton, and white potatoes in neighboring States*

Crop, State, and date	Number of reports	Average prices for series		Standard deviations for series		Correlation coefficient (r.)
		X [1]	Y [2]	X [1]	Y [2]	
Wheat, per bushel:						
Maryland and Pennsylvania—		*Cents*	*Cents*	*Cents*	*Cents*	*Plus*
1908–1914	84	98.3	99.1	9.6	9.2	0.975
1915–1921	84	180.1	177.9	52.9	50.1	.989
1922–1925	48	126.0	125.6	25.6	24.4	.989
1908–1925	216	136.2	135.6	50.6	48.8	.994
Pennsylvania and New York—						
1908–1914	84	99.1	100.4	9.2	8.0	.974
1915–1921	84	177.9	178.8	50.1	51.4	.988
1922–1925	48	125.6	130.1	24.4	23.7	.986
1908–1925	216	135.6	137.5	48.8	48.9	.994

[1] Indicates the series mentioned first, as Maryland in the first comparison.
[2] Indicates the series mentioned second, as Pennsylvania in the first comparison.

TABLE 23.—*Farm prices: Correlation between the farm-price series of wheat, cotton, and white potatoes in neighboring States*—Continued

Crop, State, and date	Number of reports	Average prices for series		Standard deviations for series		Correlation coefficient (*r*)
		X	Y	X	Y	
Wheat, per bushel—Continued.						
Indiana and Illinois—		*Cents*	*Cents*	*Cents*	*Cents*	*Plus*
1908–1914	84	95.8	93.6	10.9	9.1	0.975
1915–1921	84	176.0	174.2	49.2	50.2	.998
1922–1925	48	124.3	120.1	25.7	24.4	.994
1908–1925	216	133.3	130.9	49.1	49.4	.998
Cotton, per pound:						
Texas and Georgia—						
1909–1914	72	11.6	12.0	1.98	2.12	.976
1915–1921	84	20.8	21.8	9.30	10.50	.995
1922–1925	48	23.7	24.2	4.09	4.23	.984
1909–1925	204	18.2	18.9	8.15	8.63	.995
Potatoes, per bushel:						
Maine and New York—						
1909–1914	84	60.4	72.0	22.2	21.7	.923
1915–1921	84	125.0	137.9	75.4	75.6	.988
1922–1925	48	78.3	96.6	34.7	38.4	.890
1909–1925	216	89.5	102.3	59.3	59.5	.976

Table 23 also gives a comparison of the average prices and standard deviations of the monthly prices in the different periods. The New York price of 137.5 cents was the highest average price of wheat for the entire period. The Maryland price of 136.2 cents was slightly lower than the New York price, but higher than the Pennsylvania price (135.6 cents), the Indiana price (133.3 cents), or the Illinois price (130.9 cents). The price differential between Indiana and Illinois was greatest during the last period, when freight rates had been increased. The average price is lower as it approaches the centers of wheat production for the country. The dispersions of these monthly prices were similar in the several States in a given period, and it is difficult to say that the dispersion was any greater in one State than in any of the others.

COTTON

Although Texas and Georgia are not adjoining States and the harvest begins earlier in southern Texas than in Georgia, the correlation during the pre-war period between Texas prices of cotton lint per pound and Georgia prices, plus 0.976, is unexpectedly high. The correlation during the war period is plus 0.995. The average price was slightly higher in Georgia than in Texas; and the dispersion of monthly prices as measured by their standard deviations was slightly greater. Figure 7 shows the general trend and close correlation of monthly cotton prices for Texas and for Georgia, and for purposes of comparison New Orleans spot prices of middling cotton.

POTATOES

It is difficult to find any two States in which, over a period of time, conditions influencing potato prices are even reasonably comparable. Maine is a long distance from market, whereas parts of New York State are within easy trucking distance of New York City and other large cities. Maine has no section that compares with the Long Island potato area of New York, either in nearness

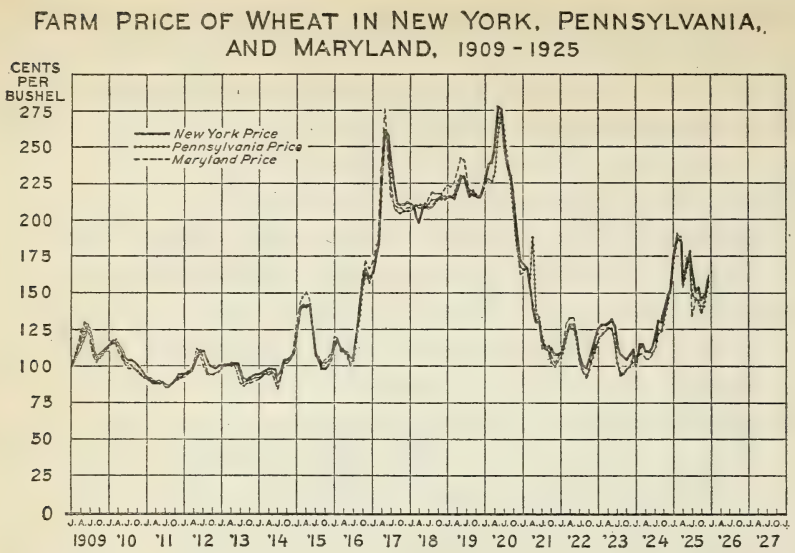

FIG. 5.—The farm prices of wheat in Maryland and in Pennsylvania show the following plus correlations: 0.975 for the period from 1908 through 1914; 0.989 from 1915 through 1921; 0.989 from 1922 through 1924; and 0.994 for the entire period from 1908 to 1925. The plus correlations between Pennsylvania and New York farm prices of wheat are 0.974 for the first period; 0.988 for the second period; 0.986 for the third period; and 0.994 for the entire period from 1908 to 1925. The average price for each of the three periods was higher in New York than in Pennsylvania. This difference was greatest in the last period. The average of Pennsylvania prices was slightly higher than that of Maryland prices from 1908 to 1914, but was slightly lower during the last two periods. (See Table 23.)

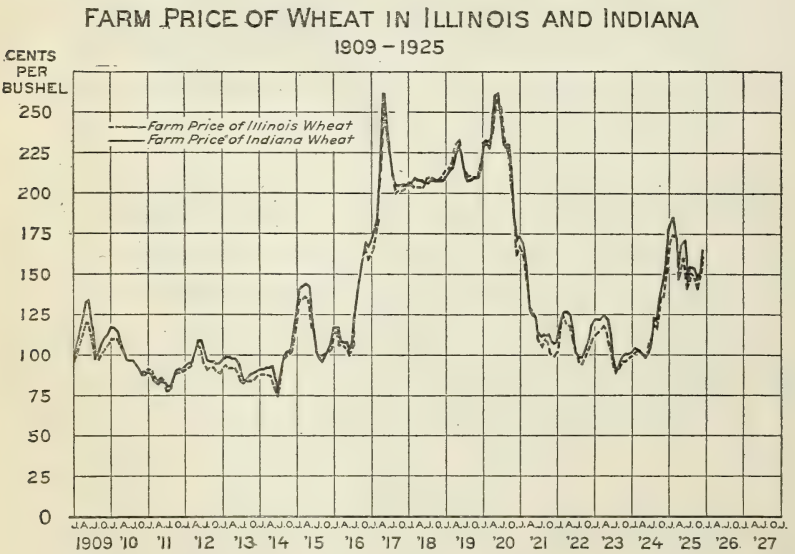

FIG. 6.—The farm prices of wheat in Indiana and Illinois show the following plus correlations: 0.975 for the period from 1908 through 1914; 0.998 from 1915 through 1921; 0.994 from 1922 through 1925; and 0.998 for the entire period from 1908 through 1925. Indiana and Illinois farm prices of wheat have shown a greater spread during the last five years, when freight rates have been higher, than they showed during either of the previous periods. (See Table 23.)

to market or time of harvest. In addition to the many differences between the two States from a potato-price standpoint, potato prices as reported each month have two or three times the variability or dispersion of wheat or cotton prices. There is no world price for potatoes in the same sense that there is for wheat and for cotton, nor is the potato market so well organized. Plus correlation coefficients of 0.923 for the pre-war period, 0.988 during the war and postwar inflation, and 0.890 for the last few years, indicate that, in spite of the many disturbing factors, the tendency is very strong for the price of potatoes in the two States to parallel each other month by month. It is not nearly so close a relationship as that between cotton prices in Southern States, or wheat prices

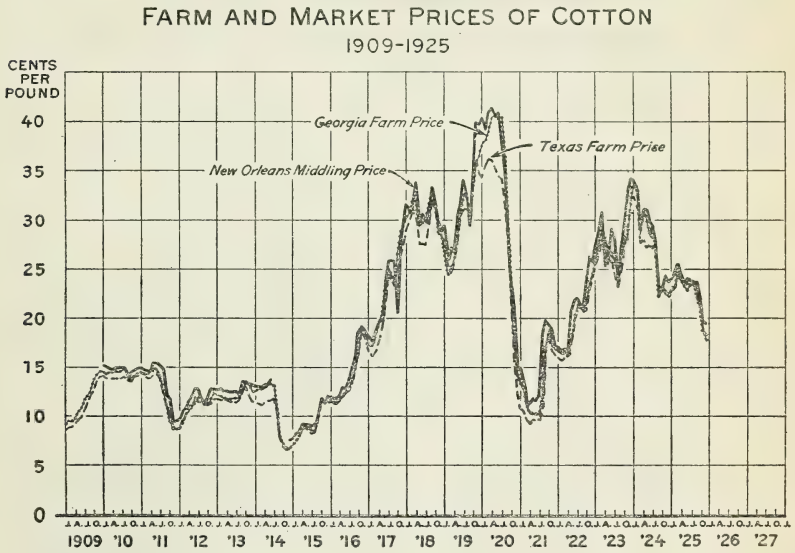

FIG. 7.—The correlations between the farm prices of cotton in Texas and the average prices of middling cotton at New Orleans for the five days ending the 15th of each month are +0.957 in the pre-war period, from 1910 through 1914; +0.991 from 1915 through 1919; +0.979 from 1920 through 1925; and +0.989 for the entire period from 1910 through 1925

in Northern States, but it is important nevertheless. Figure 8 shows the general relationship of the farm-price series in Maine and for New York.

A COMPARISON OF FARM PRICES WITH MARKET PRICES

It is difficult to obtain series of market prices that are strictly comparable with series of farm prices and can therefore be used to show their bias. The historical series of farm prices of a product in any State would not be closely correlated with a historical series of the price of that product at a primary market unless the State had been continually either a surplus-producing or a deficit State for the entire period for which prices are being compared. There are only a few farm products, even in surplus-producing States, which enter the regular channels of trade in the same general proportion year

after year. In a year of low production in certain parts of the country, the usual movement of the crop from the farm to primary markets may be reversed. When the winter wheat crop in Kansas is very short, spring wheat may be shipped into Kansas to take care of the local milling demand, and the usual price differentials between farm and market prices may be changed materially.

The corn price in an Iowa county may be the primary-market price less the cost of handling and transportation to the primary market, say Chicago, during a year when a considerable surplus of corn is produced. The next year the crop may be small; farmers may be buying corn from each other and from near-by counties or States, as in 1924–25; and the price at which local corn will be sold may be nearly as high or higher than the primary-market price.

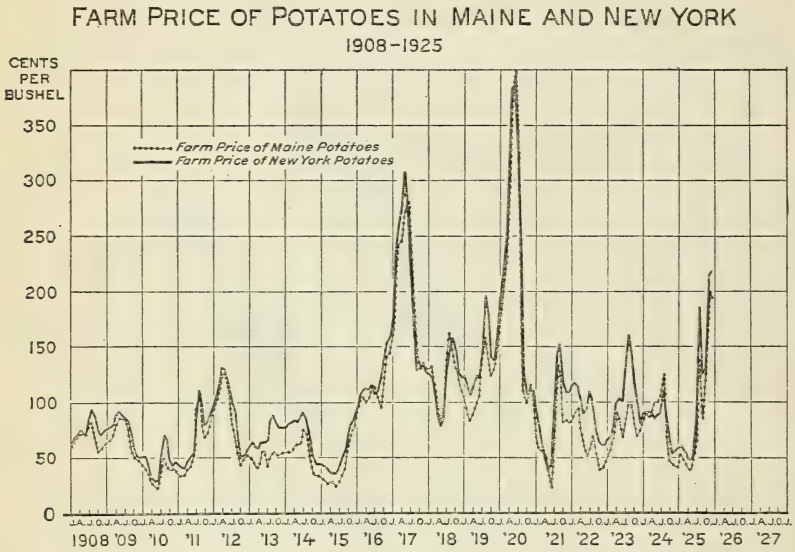

FIG. 8.—Farm prices of potatoes for Maine and for New York show plus correlations of 0.923 in the pre-war period, 0.988 during the war and postwar inflation, and 0.890 for the last few years. The relationship between potato prices in two surplus-producing States is not as close as that between wheat or cotton prices in two surplus-producing States

There is an opportunity to compare the movements of farm prices and of primary-market prices when (1) the State as a whole may be considered as a surplus-producing region and (2) a large proportion of the product is marketed through primary markets year after year. Usually crops of cotton, wheat, flaxseed, and hogs in the heavy surplus-producing States fulfill both these requirements.

IOWA HOG PRICES

In view of the fact that about one-fourth of the hogs slaughtered under Federal inspection come from the State of Iowa and about 40 per cent or more of Iowa hogs are marketed in Chicago and over 50 per cent of the hogs marketed in Chicago come from Iowa, it would seem that the farm price of hogs in Iowa would be closely related to the average price of hogs on the Chicago market.

Since the farm price of hogs is reported as of the 15th of the month, the monthly average price of hogs on the Chicago market would not be entirely satisfactory, inasmuch as the market prices during the last half of the month would not affect the farm price on the 15th. The weekly average Chicago prices for the weeks ending the fifteenth of each month would probably be the best basis for comparison, but the weekly average prices of the Bureau of Agricultural Economics since 1920 for "packer and shipper droves" and those published by the Chicago Drovers' Journal are for the calendar week.

The weekly average prices of hogs for the weeks ending about the 15th of each month were obtained by roughly interpolating the published weekly prices mentioned above. The period from January, 1910, to May, 1925, was divided into three periods: The first five years (January, 1910–December, 1914) was a period when the price level was practically unchanged; during the second five years (January, 1915–December, 1919) changes in price level would increase the correlation; and during the third period (January, 1920–May, 1925) the correlation would also be influenced by changes in price level. The plus correlations between these Chicago average market prices and the Iowa farm prices were 0.992 for the period 1910–1914, 0.998 for the period 1915–1919, and 0.997 for the third five-year period. The difference or spread between the market price and the farm price in the first period, 1910–1914, was from 43 to 90 cents, averaging 65 cents, with a standard deviation of 13 cents. In other words, when hog prices in Chicago averaged $6 per hundredweight, the spread between the Chicago market price and the Iowa farm price was between 51 and 77 cents in two-thirds of the cases.

During the second period, 1915–1919, when Chicago hog prices averaged about $13.60, ranging from $6.40 to nearly $22, the spread between market prices and farm prices averaged 90 cents, with a standard deviation of 18 cents. During the past five and one-half years, when hog prices in Chicago have averaged $9.75, the average spread has been 82 cents, with a standard deviation of 25 cents.

A detailed study of the difference or spread between the farm price and the market price shows that the spread tends to be the greatest when the price has been advancing rapidly and the least when the price has been dropping rapidly. The local hog buyer is an important factor in Iowa hog marketing, and his margin of profit apparently serves as a cushion to absorb the more violent price fluctuations. This series of farm prices seems to have about the same variability as the weekly average of prices of the same product at a central market, perhaps a little more at times. The standard deviation for the first period (1910–1914) of the farm-price series for Iowa hogs was 97 cents and the coefficient of variability 13 per cent, as compared with 99 cents and 12 per cent for the Chicago weekly market-price series. For the second period (1915–1919), the standard deviation of farm prices was $4.56 and the coefficient of variability 36 per cent, and the standard deviation of market prices $4.77 and the coefficient of variability 35 per cent. During the last period, the respective deviations were $2.55 and $2.67 and the coeffi-

cients of variability 29 and 27 per cent. These comparisons appear in Table 24. Figure 9 shows graphically the relationship between the two series of hog prices.

TABLE 24.—*Comparison of farm prices and market prices*

Products, prices, and dates	Number of months	Average of price series		Standard deviations of series		Coefficient of variability of series		Correlation coefficient (r)
		X_1[1]	X_2[2]	X_1[1]	X_2[2]	X_1[1]	X_2[2]	
Farm prices of Iowa hogs, and Chicago market prices: [3]		*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Per cent*	*Per cent*	*Plus*
1910–1914	60	7.35	8.00	0.97	0.99	13	12	0.992
1915–1919	60	12.70	13.60	4.56	4.77	36	35	.998
1920–May, 1925	65	8.93	9.75	2.55	2.67	29	27	.997
Farm prices of Kansas wheat, and monthly average market prices at Kansas City:		*Cents*	*Cents*	*Cents*	*Cents*			
July, 1920–December, 1923	42	115.9	133.2	36.0	41.0	31	31	.990
Farm prices of Kansas wheat, and average market prices at Kansas City, weeks ending the 15th of each month:								
July, 1920–December, 1923	42	115.9	135.1	36.0	43.0	31	32	.984
Farm prices of North Dakota wheat, and monthly average market prices at Minneapolis:								
July, 1920–December, 1923	42	114.6	141.3	38.4	37.7	34	27	.987
Farm prices of North Dakota wheat, and average market prices at Minneapolis, weeks ending 15th of each month:								
July, 1920–December, 1923	42	114.6	143.5	38.4	40.5	34	28	.984
Farm prices of Texas cotton, and average prices of middling cotton at New Orleans, 5 days ending the 15th of each month:								
1910–1914	60	12.00	12.89	1.69	1.85	14	14	.957
1915–1919	60	20.71	21.73	8.79	9.34	42	43	.991
1920–1925	72	22.85	24.64	7.11	7.89	31	32	.979
1910–1925	192	18.92	20.19	8.12	8.76	43	43	.989

[1] X_1 indicates the farm price series in each comparison.
[2] X_2 indicates the market price series which is being compared with the farm price series.
[3] Chicago market prices obtained for the weeks ending the 15th of each month by interpolating prices of calendar weeks.

KANSAS AND NORTH DAKOTA WHEAT PRICES

Prior to January, 1924, wheat prices as well as the prices of other important crops, were obtained on the 1st of the month instead of the 15th. The prices for the two consecutive dates were averaged to obtain a price which would be a little more comparable with prices as obtained on the 15th. This method of averaging two prices tends to lessen the price change from one month to the next.

A comparison of the Kansas farm price of wheat and the Kansas City cash-sale price was made for the period from July, 1920, to December, 1923. The correlation between the monthly average sale price for Kansas City (p. 629) and the Kansas farm price (the average of the first of two consecutive months) was plus 0.990. The correlation between a weekly average of Kansas City cash-sale price for the week ending the 15th of each month (average price of all sales for the six-day period) and the Kansas farm prices as just described was plus 0.984. See Table 24 for a comparison of wheat prices. A similar study comparing North Dakota farm prices of wheat and the Minneapolis monthly average cash-sale prices showed a correlation of plus 0.987. The correlation between North Dakota

farm prices and Minneapolis weekly cash-sale prices for the week ending the 15th of each month was plus 0.984.

The variability of the farm-price series for Kansas wheat was practically the same for this period as the variability of the weekly and monthly averages of the market prices of wheat at Kansas City. The coefficient of variability for the farm-price series for Kansas wheat was 31 per cent, as compared with 31 per cent for the monthly average market prices at Kansas City and 32 per cent for the average market prices at Kansas City for the weeks ending the 15th of each month. The North Dakota farm-price series for wheat, with a coefficient of variability of 34 per cent, showed greater variability than either the market prices at Minneapolis for the weeks ending the 15th of each month, which had a coefficient of variability of 28 per cent or the monthly averages which showed 27 per cent variability. Figures 10, 11, 12 and 13 show the relationships of farm and market prices of wheat for this period in these States.

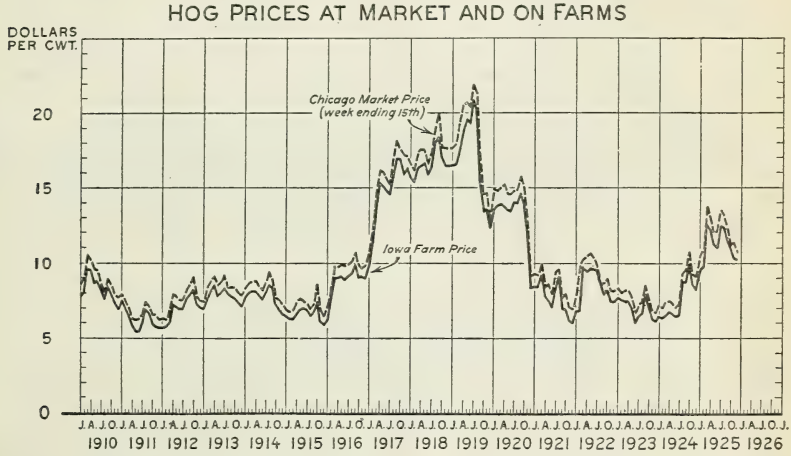
HOG PRICES AT MARKET AND ON FARMS
DOLLARS PER CWT.
Chicago Market Price (week ending 15th)
Iowa Farm Price
20
15
10
5
0
1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926

FIG. 9.—A comparison of these two price series show plus correlations of 0.992 for the period 1910–1914, 0.998 from 1915 through 1919, and 0.997 from 1920 to May, 1925

TEXAS COTTON PRICES

A similar comparison of the Texas farm prices of cotton and the New Orleans prices of Middling cotton for the five days preceding the 15th of each month also shows a high degree of correlation between them. The farm prices of cotton prior to December, 1923, were obtained on the first of each month, and the 15th-of-the-month price was approximated by taking the average of two consecutive months. The New Orleans price was for a definite grade, although the quality and grade of the cotton sold in Texas varies considerably from year to year, and even from month to month. For the pre-war period, 1910–1914, the correlation was plus in the period 0.957; in the period 1915–1919, when changes in price level would tend to increase the correlation, it was plus 0.991, and in the period 1920–1925 it was plus 0.979. For the entire period the correlation was plus 0.989. Table 24 shows the details of this cotton-price comparison and Figure 7 presents graphically the relationship between both the

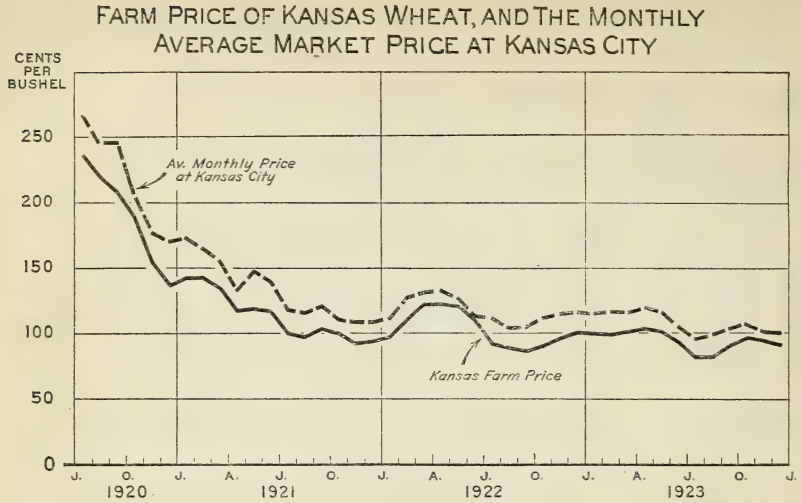

FIG. 10.—Kansas farm prices of wheat reported on or about the first of each month, with the prices for two consecutive dates averaged to obtain a price for a given month, and monthly average sale prices at Kansas City show a correlation of +0.990. Since January, 1924, all farm prices have been obtained on or about the 15th of each month

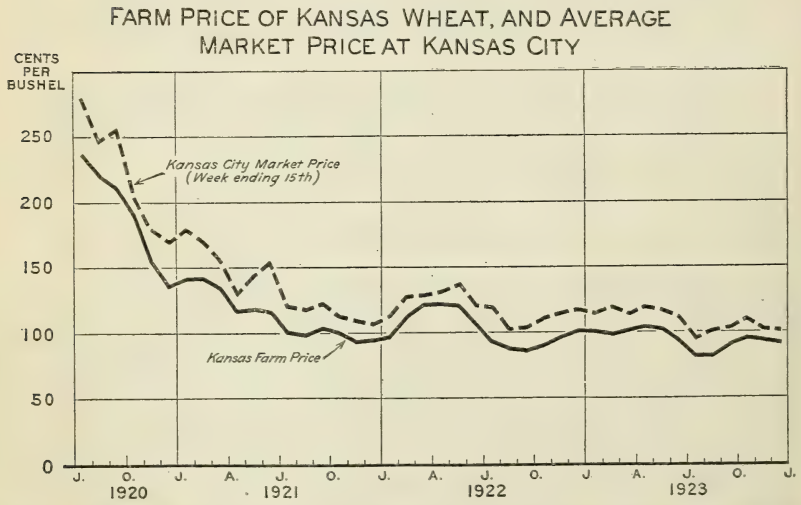

FIG. 11.—Kansas farm prices of wheat reported on or about the first of each month, with the prices for two consecutive dates averaged to obtain a price for a given month, and averages of all sales on the Kansas City market for the weeks ending the 15th of each month show a correlation of +0.984. Since January, 1924, all farm prices have been obtained on or about the 15th of each month

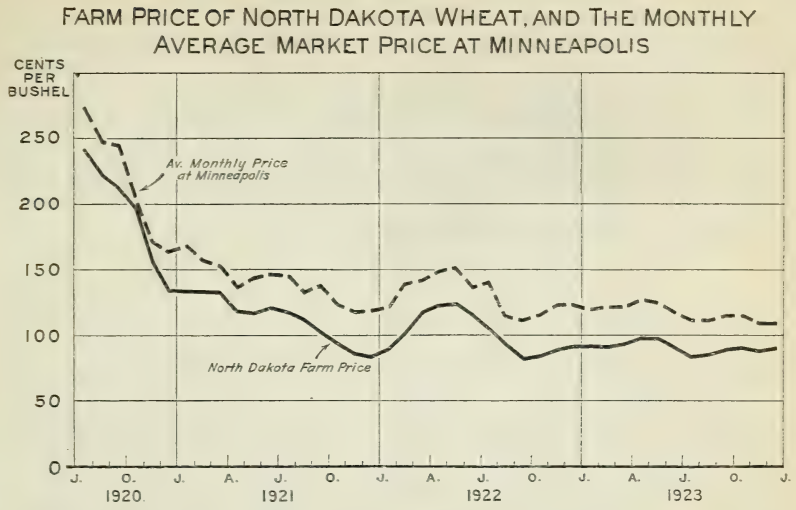

FIG. 12.—North Dakota farm prices of wheat reported on or about the first of each month, with the prices for two consecutive dates averaged to obtain a price for a given month, and monthly average sale prices at Minneapolis show a correlation of +0.987. Since January, 1924, all farm prices have been obtained on or about the 15th of each month

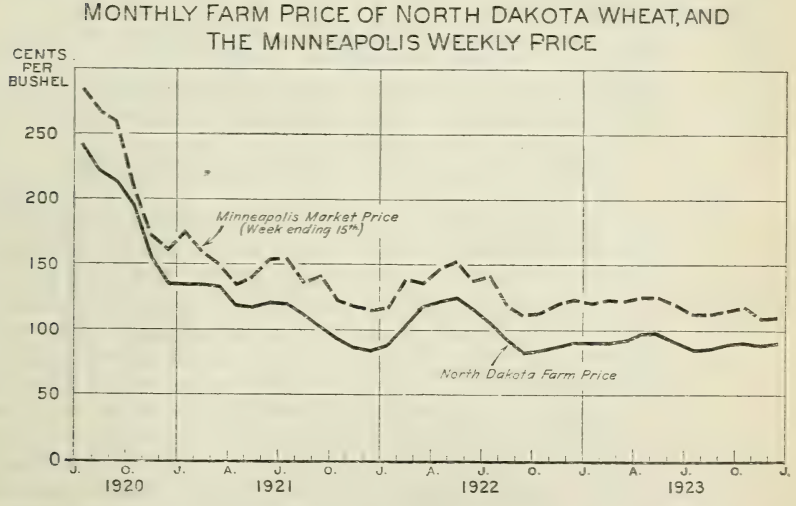

FIG. 13.—North Dakota farm prices of wheat reported on or about the first of each month, with the prices for two consecutive dates averaged to obtain a price for a given month, and averages of all sales on the Minneapolis market for the weeks ending the 15th of each month show a correlation of +0.984. Since January, 1924, all farm prices have been obtained on or about the 15th of each month

Georgia and Texas farm prices of cotton and the New Orleans prices for Middling cotton.

UTILIZATION OF FARM-PRICE DATA

No one series of prices is equally suitable for all purposes, but for practical reasons it is not feasible to develop a new series of prices to fit each new use. Those using the farm-price data of the department should, therefore, understand their characteristics and realize both their advantages and limitations. For this reason a few of the purposes for which the farm prices are used are listed below, and some of the more outstanding advantages and disadvantages of the series for each purpose are discussed.

COMPUTATION OF VALUE OF CROP PRODUCTION

The December 1 prices of crops were developed primarily for the purpose of calculating, as of a given date, the value of individual crops in the various States. Within each State these prices are weighted by acreage, a fairly close measure of relative production within a State, whereas the United States average is weighted by production in the several States. The December 1 prices have been obtained since 1866 and are used to determine the value of crop production as of December 1. These values have been used as a basis for comparing the value of the same crop in the different States and the values of different crops in the same State and in the United States. They have also been used as a means of comparing over a period of years values of individual crops and the gross value of crop production and for comparing the value per acre of different crops and of all crops both in different States and over a period of years.

The series of monthly prices of farm crops, begun in 1908, is weighted in the same manner as the December 1 prices, and the weighted crop-year average of the monthly prices has also been used in computing the value of crop production for the whole United States.

A pertinent question in connection with the use of farm-price data in computing the value of crop production is whether the price received for the quantity of a product sold is a fair indication of the value of the quantities not sold. There is no other very satisfactory method of valuing products that are not bought or sold. Corn silage, for example, is almost never sold. It may be variously valued by different individuals at the cost of production or at what it is worth for feed in comparison with the cost of other available feeds. Valuations on either of these bases or on any other base are difficult to obtain from voluntary correspondents, since the question requires them to make an estimate in regard to something they have no adequate basis for judging. The department avoids this difficulty by assuming that corn put into a silo has the same value per acre as corn husked for grain. This gives a total value which may be only approximately correct but which has the advantage of showing yearly changes very accurately.

Not all of the corn crop is of merchantable quality; it varies greatly in different years. The farm price of corn is based on the

merchantable grades of corn which are actually sold by the farmer; yet this price per bushel is applied to all corn, including the unmechantable grades. The farm price of hay is based on the relatively few tons of hay sold. In years of large potato crops, large quantities of potatoes are fed to livestock or allowed to waste. Since the merchantability of corn varies from year to year, the comparability of corn-price data is decreased to some extent. Although the potential supply undoubtedly has considerable influence on the price of that which is sold, it is possible that the per unit farm price of such crops as corn, potatoes, hay, and apples may be too high to use in determining the gross value of production. It is this very factor which should exclude the use of gross crop-value production figures as fully indicative of farm-purchasing power, from year to year, either relative or absolute.

One partially compensating fact, however, is often overlooked, namely, that the price of a product is usually low in those areas where it is extensively raised for sale and relatively high in areas where farm consumption exceeds supply. The number of farmers growing potatoes is approximately four times the number of farmers who sell potatoes. On many farms that raise the crop for home consumption only the product is really worth as much as it would cost if purchased at retail at local stores—a price which would be materially above the farm price in surplus-producing areas.

Another difficulty is the impossibility of adequately weighting the prices of crops that vary considerably as to local distribution. Suppose that in a given county there is one merchant who lives in a grain section and deals principally in wheat and that a few miles away there is another who deals principally in apples. In reporting the local prices of farm products, these men would ordinarily report wheat and apples. The wheat dealer estimates the price of apples chiefly from some small quantity sold locally; the apple buyer estimates the price of wheat in the same way. The result is that when the estimates of the two men are averaged without information as to the quantities of each product represented in the estimate the average is too largely influenced by the price in the less-important locality.

The difficulties in connection with the use of farm prices as a measure of the unit value of crop production are largely offset by the fact that the price obtained is a local farm-market price and that such prices are weighted primarily by production. The average values per unit for the United States are fairly close to the values that are determined when each individual farmer is asked to place a value on his crops. Table 25 shows a comparison of 1909–10 values per unit of crops as determined by the United States Census for that year and farm prices. In April, 1910, census enumerators asked each farmer the quantity and value of each crop produced on his farm in 1909. The census average values, for the United States of corn, wheat, barley, and rye per bushel, were from 2 to 3 cents lower than the December 1 farm prices by States, weighted by census production, whereas the price of oats was 0.6 cent higher. The census value of potatoes was 42.8 cents per bushel, as compared with a December 1 price of 54.2 cents and a weighted crop-year price of 57.9 cents.

TABLE 25.—*Values per unit of crops as shown by the 1910 census, December 1 farm prices, and monthly farm prices*

Crop	Census value per unit, 1909	Farm prices					
		Dec. 1, 1909		Monthly [2]			Season average, 1909–10 [3]
		A [1]	B [2]	November, 1909	December, 1909	April, 1910	
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Corn	56.4	58.6	60.4	60.0	60.0	64.5	63.7
Oats	41.2	40.6	41.3	40.6	41.5	44.4	43.0
Wheat	96.2	98.4	100.5	99.2	101.0	102.2	101.3
Barley	53.3	54.8	54.0	53.6	55.8	58.1	55.8
Rye	69.2	72.2	73.8	73.7	73.3	75.8	74.5
Cotton	13.2	13.9	13.9	13.8	14.2	14.0	14.0
Potatoes	42.8	54.2	56.4	56.0	55.0	42.9	57.9

[1] Revised prices weighted by census production by States.
[2] Weighted by preliminary production by States.
[3] Average of monthly prices weighted by usual rate of marketing.

Farm prices generally were higher than census values. The annual weighted averages of monthly farm prices were higher than the December 1 prices, partly because December was a month in which prices generally were lower than the average for the season and partly because census production weights were not available for weighting the monthly prices of that year. This is shown by the lower December 1 prices resulting when the new census production weights were used. The much lower census value of potatoes per bushel may be due in part to the fact that the April price of potatoes was much lower than the November price or the December price, and April was the month when the census was taken. Some of the difficulties which have been mentioned above, such as the fact that the price of the quantity sold was higher than that of the portion of the crop not sold, may also have had an effect.

COMPARISONS OF VALUE PER UNIT OF CROP PRODUCTION

It is obvious that the price for any one month would differ considerably from a crop-year average of monthly prices weighted by the rate of marketing. Table 26 shows the percentage differences between December 1 prices and the crop-year average of monthly prices weighted by relative monthly marketings. As would be expected, the December 1 price is more often below the annual average than above. In only 3 cases were the December 1 prices of crops which are harvested late in the season, such as corn, buckwheat, potatoes, sweet potatoes, clover seed, and beans, higher than the annual averages, whereas in 76 cases the annual averages were the higher. This might be expected in as much as farm prices in the later months of smaller marketings should in the long run be enough higher than the early season prices to compensate for storage costs and shrinkage losses.

TABLE 26.—*Percentage difference between December 1 prices and crop-year average [1] of monthly prices*

Crop	Dec. 1 price in excess of crop-year average price		Crop-year average price in excess of Dec. 1 price	
	Number of years	Range of percentages	Number of years	Range of percentages
Corn	1	4.5	14	3.9–26.7
Wheat	3	0.6–6.3	12	1.6–22.1
Oats	4	.5–2.3	11	1.1–14.5
Barley	4	.2–3.9	11	1.3–9.9
Rye	5	.5–5.8	10	.3–14.5
Buckwheat [2]	0		14	.6–10.8
Flaxseed [2]	4	1.4–4.0	10	.3–15.2
Potatoes	0		15	1.9–21.7
Sweet potatoes	0		13	7.2–24.2
Hay	6	.6–2.7	9	2.0–25.4
Clover seed [3]	1	.1	12	1.0–10.8
Cotton	9	.7–29.8	6	.8–47.7
Cottonseed [3]	6	1.4–25.1	7	.2–10.1
Apples [2]	5	.1–9.4	7	1.3–17.0
Beans	1	6.0	8	3.4–20.8
Peanuts [3 4]	4	2.2–12.8	5	1.1–8.3

[1] Weighted by usual relative monthly marketings.
[2] 1 year, no difference.
[3] Nov. 15 price.
[4] 4 years, no difference.

A comparison of two possible farm-price series as a basis for determining the gross value of crop production for the United States from 1910 to 1923 is given in Table 27, and a comparison of the trend of these two gross values of crop production from 1910 to 1923 is shown in Figure 14.

TABLE 27.—*Gross value of United States crop production*

Year	Value based on December 1 farm price per unit			Value based on average of monthly prices for season [1]		
	Gross value	Percentage of value of preceding year	Index of value [2]	Gross value	Percentage of value of preceding year	Index of value [2]
	Millions of dollars	*Per cent*		*Millions of dollars*	*Per cent*	
1910	5,486		100	6,211		100
1911	5,562	101	101	6,495	105	105
1912	5,842	105	106	6,799	105	109
1913	6,133	105	112	6,717	99	108
1914	6,112	100	111	7,268	108	117
1915	6,907	113	126	7,957	109	128
1916	9,054	131	165	10,305	130	166
1917	13,479	149	246	14,277	139	230
1918	14,331	106	261	14,814	104	239
1919	15,423	108	281	16,569	112	267
1920	10,909	71	199	11,578	70	186
1921	6,934	64	126	7,759	67	125
1922	8,945	129	163	9,430	122	152
1923	9,953	111	181	10,401	110	167

[1] Weighted by relative monthly marketings.
[2] Value in 1910 used as 100.

The correlation between these two trends would necessarily be high as the same production figures have been used in each, and December 1 prices have tended to move closely with average prices for the year. The correlation coefficient was plus 0.997 in spite of the fact that index numbers (given in Table 27) based on 1910 as 100, differ by 1 to 9 per cent in various years. During and since the war years, the index based on December 1 prices has maintained a slightly higher level than the other, because the spread between the two gross values was less than in the base period. The correlation between the relative change in values from year to year is plus 0.979.

Table 28 shows a comparison between December 1 prices of cotton, wheat, and corn and the season average of monthly prices of cotton and wheat weighted by current monthly marketings for each year and the season averages of monthly prices of corn weighted by the usual rate of monthly marketings. The plus correlations between

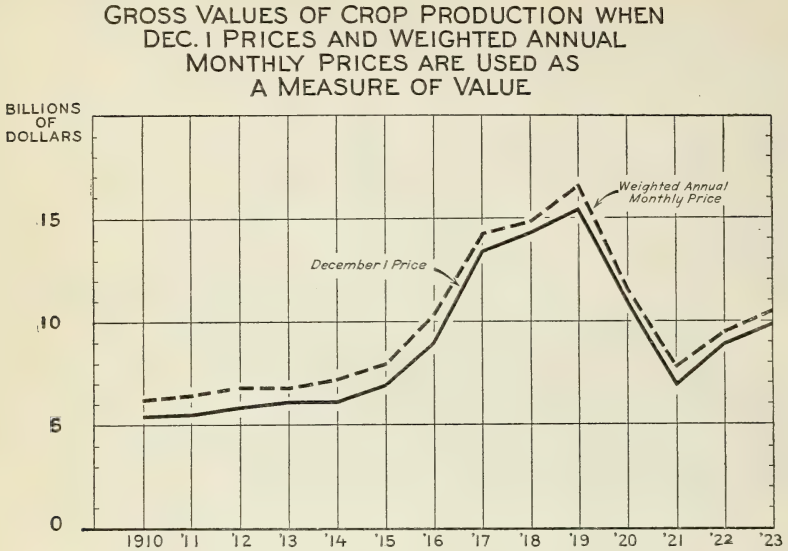

FIG. 14.—The two measures of the value of crop production show the same general trend. The correlation between the two trends is +0.997, whereas the correlation of relative values from year to year expressed as a percentage is +0.979

the two series were cotton, 0.974; corn, 0.982; and wheat, 0.974. The greatest differences occur in the years of rapidly changing price levels.

TABLE 28.—*December 1 prices and the season average prices of cotton, corn, and wheat, 1909–1924*

Year	Cotton (cents per pound)		Corn (cents per bushel)		Wheat (cents per bushel)	
	Dec. 1	Season average [1]	Dec. 1	Season average [2]	Dec. 1	Season average [1]
1909	13.9	13.6	58.6	63.7	98.4	100.7
1910	14.1	14.0	48.0	53.6	88.3	91.7
1911	8.8	9.6	61.8	69.6	87.4	88.3
1912	11.9	11.5	48.7	57.0	76.0	83.3
1913	12.2	12.5	69.1	71.9	79.9	79.3
1914	6.8	7.4	64.4	72.7	98.6	99.4
1915	11.3	11.2	57.5	70.1	91.9	98.2
1916	19.6	17.3	88.9	124.2	160.3	144.4
1917	27.7	27.1	127.9	147.6	200.8	205.8
1918	27.6	28.8	136.5	152.1	204.2	206.3
1919	35.6	35.2	134.5	150.1	214.9	218.6
1920	13.9	15.8	67.0	62.6	143.7	182.9
1921	16.2	17.0	42.3	53.4	92.6	104.4
1922	23.8	22.8	65.8	76.6	100.7	98.0
1923	31.0	28.7	72.6	83.1	92.3	92.4
1924	22.6	22.9	98.2	106.8	129.9	127.8
16-year average	18.6	18.5	77.6	88.4	122.5	126.3

[1] Season average based on monthly marketings for the current year except 1909.
[2] Season average based on the usual rate of monthly marketings.

From the standpoint of the trend of the gross value of all crop production for the United States, it makes very little difference which price is used. In the case of certain individual crops the changes from year to year may differ more if one method of computing values is used rather than the other. In computing the gross value of all crop production the individual variations are more or less compensating.

Prices on December 1 are probably as satisfactory as those on any other single date for estimating the gross value of all crop production, as it is a satisfactory date for some of the most important crops. The fact should not be overlooked, however, that for some commodities and groups of commodities other dates may be more satisfactory. Considering only the question of the value of the crop at harvest time, the logical point at which to measure that value is when the crop has just been harvested. The practice of the Bureau of Agricultural Economics in the last few years has been to add to the December 1 valuation of some of the crops the values of other crops completely harvested earlier in the season at prices that prevailed in their respective harvest seasons. The value of crops at prices prevailing at time of harvest may naturally be expected to be lower than the value on the basis of the monthly prices weighted by monthly marketings throughout the season. As is shown in Table 27, the December 1 prices give lower gross values than the weighted-average prices for the season.

After the December 1 farm prices are available, gross value of production may be computed on the basis of these prices, on the basis of the monthly prices of the season to date in comparison with past years, or upon the basis of prices to date and estimates of prices for the remainder of the year. Recent developments in statistical technique in the analysis of prices are preparing the way for using the last method with a fair degree of accuracy. In case it is desired to use a weighted-average price to compute probable income for the season, it is necessary not only to estimate the prices in advance but also to estimate the marketings monthly through the season.

As a basis for comparisons between States at a given date, the December 1 prices have the advantage of being more fully representative of all localities in the country than the monthly prices, and since they are based on a much larger sample the State average obtained is also much more reliable. For immediate use for a given State or as a basis for a comparison between States they are now available by States, while the monthly prices would have to be weighted by States. This would be no small task, as at least 1,700 weighted annual averages would have to be computed. The department has already substituted for the December 1 prices of such commodities as are not being sold on December 1, such as some vegetables and fruits, an average price or value per unit by States of commercial production based on prices received by growers during the harvest season only.

Another criticism of the use of the December 1 price in calculating the total value of staple crops is that often it does not represent the average price at the time the given crops were sold. For example, in a season when farmers obtain an average price of 70 cents per bushel for all the corn that they sell, the average December 1 price

may be only 60 cents a bushel. From some points of view 70 cents per bushel properly represents the true value of the corn crop to the farmers, yet this figure may be too high to apply to the total corn crop in calculating the total value, by reason of the fact that the element of shrinkage is involved. In the case of products such as apples and potatoes shrinkage is a factor of even greater importance than with corn.

In using a weighted season price for calculating the total value of a crop there is the difficulty that the season price can not be fully determined until the end of the crop year and the further difficulty that a portion of a crop may be carried into a subsequent season. Thus, much corn of the 1920 crop was not sold until one or two years after it was harvested. This makes it very difficult to determine accurately the value of the crop harvested in any given season.

INVENTORY VALUATION OF LIVESTOCK JANUARY 1

The January 1 values or prices of livestock per head are used in calculating the total value of livestock on the farm on January 1 of each year. They apply to the value at a given date and are not used as a measure of value covering a period of time. About the only data which are at all comparable with January 1 values would be the 1920 census values of livestock per head. Only the values of horses, mules, and sheep were obtained according to the same age and sex classification on both inquiries. A comparison of the values of these three kinds of livestock shows that the census values of horses and mules per head were generally lower and that the census values of sheep were generally higher than the January 1 values.

TABLE 29.—*Census and January 1 value per head of livestock, January, 1920*

1920	Census value	January 1 value	1920	Census value	January 1 value
Horses:	*Dollars*	*Dollars*	Sheep:	*Dollars*	*Dollars*
Under 1 year	35.58	37.22	Lambs	8.76	8.06
1 to 2 years	51.47	58.81	Ewes, 1 year and over	21.05	21.63
2 years and over	97.00	103.52	Wethers, 1 year and over	9.57	9.60
			Rams, 1 year and over	21.05	21.63
Average, all	90.15	91.52			
			Average, all	11.29	10.47
Mules:					
Under 1 year	62.38	60.16	Cattle, all	54.79	55.68
1 to 2 years	98.75	90.14	Swine, all	16.66	19.08
2 years and over	153.99	160.55			
Average, all	143.45	148.46			

The lower values of horses in the census would suggest that the values given by crop reporters reporting on the average price of horses in their localities are influenced upward by the prices prevailing for horses that are being sold and are not sufficiently weighted by the value of old worn-out horses for which there is no sale, but which would be included in the census values. In the States of surplus horse production where there is a smaller proportion of old horses, the two sources agree much more closely. The same general reasoning applies to the value of mules per head. Practically all sheep and cattle, however, are salable, and sales of the various grades and ages are made frequently. The January 1 farm prices or values of sheep

are probably influenced more by the value of small farm flocks than by the value per head of the large farm and range flocks. A difference of only a few weeks after January 1 would make a considerable difference in the average value of swine on farms because of the movement to market from farms at that time of the year. The January 1 values of the department are obtained from crop reporters not later than about the fifth of the month. The Federal Census enumeration was not completed in all sections until some time after the middle of January. The January 1 values of livestock per head are a reasonably comparable measure of inventory value of livestock from year to year and between States. They are based on a relatively large sample and, although highly variable, there are sufficient numbers of reports to render the average value a reliable measure of the central tendency of the sample even in the smaller States.

COMPUTATION OF FARM INCOME (8, 9)

No series of farm prices that is suitable for calculating the total value of crops is quite correct for calculating farm incomes, because the two calculations require different systems of weighting. For calculating values, prices should be weighted by production; for calculating income, prices should be weighted by the quantities sold. Since prices, as a rule, are lowest in those sections which produce for sale, weighting by sales usually results in a lower average price than weighting the same local estimates by production. Furthermore, since income is usually calculated by multiplying quantities sold by the price per unit received for those sold, the question of shrinkage is not involved, and carry-over can be taken care of in inventory analysis so that the proper price figures would be weighted monthly by localities in proportion to current monthly sales. Unfortunately adequate information for such weighting is available only for a few States and for only a few commodities.

The problem of agricultural incomes by States is now receiving considerable attention in several States. The farm-price data of the department are being used for these studies. For all but the smallest States and for all important farm products the farm prices by States will be reasonably satisfactory. Monthly inconsistencies tend to compensate when the weighted average for 12 months is determined for use in a State income study. For a farm product such as tobacco, which varies greatly as to grade, type, and price even within a single State, the annual average price is about the only satisfactory farm price. Monthly farm prices of tobacco are practically impossible to obtain with the present facilities for collecting farm-price data.

INDEX-NUMBER MAKING FOR FARM PRICES (5, 7)

Farm prices are now being used as the basis of farm-price index numbers both for the United States and for States singly. For this use comparability over the entire period since 1910 is important. Every effort has been made to keep the prices comparable and with the prices of the major farm crops and kinds of livestock and most livestock products, a high degree of comparability has been maintained. Changes in methods of production and marketing and in the quality produced have made the farm butter price less satisfactory for the purpose of a price-index number than the price of almost

any other important farm product. The department is now working on the problem of a more satisfactory index of the price changes in dairy products than the farm price of butter. Because of the extreme range in the price of the many types and grades of tobacco the farm price of tobacco is not considered particularly satisfactory for any purpose. The break in the series of farm prices of fluid whole milk owing to the change in 1924 from the price per gallon to the price per 100 pounds, disturbs their comparability even when the price is converted from one basis to the other. Any shift in relative importance of surplus and deficit areas of production within a State tends to upset the strict comparability of the series over a long period of time.

A close corollary of the farm-price index number is the "price relative" of the price of a farm product. The price relatives are useful in comparing the trend of prices for several different farm products, as they are the expression of the price as a percentage of the price in some common base period, as 1910–1914.

The same limitations which apply to use of farm prices for calculating farm income also apply to calculations of individual price relatives and to their use for index-number making, although in the latter case the combined index number is not likely to be appreciably influenced if the same prices are used continuously.

COMPARISONS WITH OTHER ECONOMIC DATA

In connection with various economic problems, farm prices have been compared with wholesale and retail prices of farm products and the spread between these prices has been determined as a measure of marketing and distribution costs or the farmer's share of the consumer's dollar. Farm prices should not be used in this way unless the State prices are those of States of surplus production. Farm products which reach the primary markets come from areas of surplus production, where the prices are generally lower than in deficit areas. Unless the State represents a surplus area only, the State average price will be higher than the price actually received by the producers in those sections from which the surplus products began their journey to market.

With increases in freight rates and labor costs and increased efficiency in marketing, the spread between the farm prices of various farm products and wholesale prices of farm products has changed considerably, as has also the spread between the general average of all farm prices and wholesale prices of farm products. A comparison of the index numbers of farm prices and of wholesale prices of farm products shows that the spread has been much wider since the war than it was before.

Comparisons are made between the present relative levels of farm prices and those of wholesale prices of nonagricultural commodities and between their pre-war averages. The purchasing power per unit of agricultural products in terms of the wholesale prices of all commodities or of nonagricultural commodities is determined by such a comparison.

Farm prices have been used in comparison with other data, such as land values, farm wages, industrial wages, taxes, rents, freight rates, and measures of industrial and business activity. They have

been used in comparison with the cost of production of a given product and as a factor in studies of the cost of producing livestock and livestock products. In connection with this use of a farm price it should be borne in mind that a so-called "farm price" is not usually the price at the farm but is the price at the local farm market. It usually includes the cost of transporting the product from the farm to the shipping point or market and may also include the cost of a container. With some products, such as potatoes and apples, the price which the farmer receives may cover shrinkage and storage and, in some cases, the cost of retail sales and delivery.

An adequate knowledge of relative changes in farm-price data—especially adequate information as to how the trend of farm prices compares with the trends of other prices, wages, land values, etc.—is indispensable as a basis for an intelligent constructive program for argriculture whether by Federal or State agencies or by organizations of farmers.

PRICE CHANGES AS CAUSES AND EFFECTS

Prices and price changes are both causes and effects in the field of economic phenomena. In the long run, the prices of farm products tend to control the supply. A year of relatively high prices for a given farm crop is frequently followed the next year by a marked increase in the acreage of the crop planted. Some interesting and worth-while studies have been made showing the farmer's response, in the acreage planted, and in the use of fertilizer, and the like, to changes in the price of cotton, potatoes, and other crops.

Changes in farm organization and types of farming can frequently be traced to fundamental changes in farm prices. For many problems of this kind it is important to have price series which represent price changes in the local farm market and at the same time are a composite for a definite geographical unit such as a State. Market prices are usually for a definite grade, whereas farm prices are an average of the grades actually being sold each year. Crops vary from year to year in quality and grade to such an extent that the price of one grade only would not always be a satisfactory index of the average price or value. Similar difficulties would be encountered if the price of one variety was used as a measure of price changes for an entire crop.

An intriguing field of economic research that has gained considerable attention since the war is that of price forecasting (*2*). Farm-price data are frequently the only available figures covering price changes of competing products in a particular area. The corn-hog ratio is an illustration of how the relative prices of corn and hogs at a given time may influence the supply of hogs to be marketed months in advance and hence the future price of hogs.

The greatest limitation of all in monthly farm prices and one which it is very difficult to remedy at this time is the shortness of series, as these prices extend back only to about 1910. Seventeen years is all too short a time for a study of price relationships. December 1 prices of crops and January 1 livestock values, which date back to 1866–67, are frequently helpful when a longer price series is needed; but unfortunately they do not include the prices of livestock products such as butter, milk, eggs, and wool.

The department is now cooperating with several States in building up an adequate series of farm prices for the period prior to 1908–10. The necessary information is being obtained from old account books of farmers and dealers in agricultural products, sale slips, newspaper files, court records, and other documents. This step is fundamental before even an approach can be made to some of our economic problems. Market prices can never fill all the needs of economic research.

SUMMARY

Farm prices show price changes in the local farm market and are at the same time a composite for a definite geographical unit such as as a State. They are an average of the grades, varieties, and qualities being sold each year and include prices from surplus-producing and deficit areas within any given State.

A detailed statistical analysis of the monthly farm-price samples for various products in many States indicates that the prices of the more important farm products in all States except a few of very limited size are based on a sufficient number of reports to render the average reasonably stable and reliable. There are a few cotton States, such as Louisiana, where a larger number of reports would be desirable. Although many of the far Western States are large in size, the area farmed is often relatively small, and conditions are so varied in different parts of the same State that it is extremely difficult to obtain a sufficiently large sample or number of reports to give stability to the average.

It is not feasible, with the facilities available, to strive for the same high degree of reliability in prices of minor products or of products which are little sold by farmers, because to do so would necessitate having a very large number of reporters. But even the price data for minor products afford valuable information as to the general trend of prices over a period of a year or more.

Generally speaking, the December 1 prices of crops and the January 1 values of livestock are based on so many more reports than the monthly prices that the State averages for those dates, especially those of minor farm products, are more reliable than the monthly prices. It is not unusual, however, for a sample of December 1 prices or of January 1 values to show greater variability than a corresponding monthly price. There is the additional assurance at the present time that these prices and values are also obtained from another list of crop reporters reporting to the State statisticians, and the results from both samples combined to obtain the final figure.

No one series of prices is equally suitable for all purposes, but for practical reasons it is not feasible to develop a new series of prices for each new use. Those using the farm-price data of the department, should, therefore, understand their characteristics and realize both their advantages and limitations.

The December 1 and monthly prices, being weighted by production rather than by sales, are better adapted for the purpose of calculating the value of crops and crop production than for the purpose of determining agricultural or farm income. The farm prices are a better measure of the price level of farm products over a period of time than are wholesale prices.

The most serious limitation of the monthly farm-price data is the shortness of the series, inasmuch as monthly farm prices date back only to about 1910. December 1 prices of crops and January 1 livestock values, dating back to 1866–67, are helpful when a longer farm price series is needed, but unfortunately they do not include the prices of livestock products such as butter, milk, eggs, and wool.

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